

SERVICE MANUAL
FOR
ONAN ELECTRIC PLANT

Manufactured by
D. W. ONAN & SONS
MINNEAPOLIS 5, MINNESOTA

3-45 3M

6-2-44 1200

READ THIS BOOK CAREFULLY AND
PRESERVE FOR FUTURE REFERENCE

WARNING

THIS ELECTRIC PLANT MUST BE INSTALLED AND BE OPERATED ACCORDING TO OUR INSTRUCTIONS. AN IMPROPER INSTALLATION OR THE USE OF OIL OR FUEL OTHER THAN THAT RECOMMENDED IN THIS MANUAL, RELIEVES THE MANUFACTURER OF ALL RESPONSIBILITY FOR PLANT PERFORMANCE.

READ THIS SERVICE MANUAL CAREFULLY!

GENERAL INFORMATION

THE PURPOSE OF THIS BOOK - This instruction book is furnished so that each operator can familiarize himself with the characteristics of the plant. A thorough understanding will help to maintain plant efficiency and continuous service. It will assist the operator in determining the cause of trouble if it occurs. The various subjects treated in this book are of vital importance to the performance and service which the plant renders.

KEEP THIS BOOK HANDY - A very simple error on the part of the operator in the use of improper oil, fuels, or in neglect of routine servicing and inspection, may cause the plant to fail at a time when its satisfactory operation is essential. For this reason, we strongly urge that the book be kept on hand, near the plant if possible, so it can be referred to in time of need.

SERVICE - If trouble occurs or parts are needed which the operator or a capable service man cannot determine, the manufacturer will furnish any advice needed. When asking for advice, be sure to furnish the

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WARRANTY

Each ONAN Electric Generating Plant is:

1. WARRANTED to produce its rated output as stamped on its nameplate, when installed and operated according to the manufacturer's instructions.
2. WARRANTED to be in good condition mechanically and electrically when shipped from the factory.
3. WARRANTED against defective workmanship and materials for a period of one year after it leaves the factory. Within that time, any parts will be repaired or exchanged free of charge if they are returned, transportation prepaid, to the factory, and are found to be defective by factory inspection.

This warranty does not include or cover standard accessories such as carburetors, magnetos, fuel pumps, etc. made by other manufacturers. Such accessories have separate warranties made by the respective manufacturers. Repair, or exchange, of such accessories will be made by us on the basis of such warranties.

This warranty does not include or cover reimbursement for labor or material cost incurred in remedying any claimed defective condition in any plant unless previously authorized by the factory.

This warranty is effective only if conditions herein are complied with.

D. W. ONAN & SONS
Minneapolis, Minn.

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I M P O R T A N T ! !

USE OF LEADED FUELS

The performance of gasoline engines deteriorates with use until it eventually becomes necessary to remove the carbon, grind the valves, install new spark plugs, etc.

Lead is added to many gasolines to increase the octane rating. Due to the action of the lead in the combustion chamber, on the valve seats, and on the spark plugs, the use of such fuels causes the engine performance to deteriorate more rapidly. When using highly leaded fuel, there is a regularly increasing lead content in the crankcase oil.

If the gasoline contains 1/2 cubic centimeter, or less, of lead per gallon there is little such effect. However, as the proportion of lead is increased the deterioration in engine performance is greatly accelerated.

Under normal operating conditions with unleaded fuel it may be necessary to remove carbon each 1000 operating hours, grind valves each 1000 to 2000 operating hours, clean spark plugs each 200 operating hours, and change crankcase oil each 100 to 200 operating hours.

When using Army 80 octane fuel, aviation 100 octane fuel, or other fuel containing more than 2 cubic centimeters of lead per gallon, change the crankcase oil each 50 operating hours. When using such highly leaded fuels it may be necessary to remove carbon and grind valves each 100 to 200 operating hours, clean spark plugs each 50 operating hours, and replace them each 100 to 200 operating hours. If carbon is removed every 100 to 150 operating hours, the periods between valve grinding jobs usually can be considerably lengthened.

When using leaded fuels, inspect the engine more often and give it the more frequent service required.

DESCRIPTION

48S-6

The Power unit 48S-6 to which this instruction manual applies, consists of a gasoline engine and an electric generator with accessories and controls. The engine and generator are direct and solidly connected and form a single, compact unit. A carrying handle is mounted on top of the cylinder air housing adding convenience for transporting purposes.

Power unit 48S-6 is constructed for the primary purpose of charging batteries but may be used to furnish electricity for a small lighting system.

Power unit 48S-6 supplies direct current at 12-16 volts. The rated capacity is 0.4 K.W.

GENERAL DATA

Output Rating.....	0.4 K.W.
Voltage.....	12-16 Volts
Drive.....	Direct Connected
Engine Cylinders.....	1 Cylinder
Speed.....	2000 r.p.m.
Engine Horsepower.....	1 H.P.
Cooling.....	Air Cooled
Fuel.....	Gasoline, 62 to 80 Octane
Cranking.....	Electric and Manual
Crankcase Oil Capacity.....	1 Qt.
Fuel Tank Capacity.....	3 Qt.

Dimensions:

Length.....	15 1/2"
Width.....	9 1/2"
Height.....	20"
Net Weight.....	90 Lbs.
Shipping Data.....	Export Packed
Length.....	25"
Width.....	20"
Height.....	29 1/2"
Cubage.....	6.9 cu. ft.
Shipping Weight.....	149 lbs.

ELECTRICAL DETAILS

GENERATOR DETAILS

This direct current generator is of the four pole, shunt wound type developing 400 watts of 12 to 16 volt current at 2000 r.p.m. engine speed. A series winding on the armature permits using the generator as a motor to start the engine. The voltage is inherently controlled by the design of the generator, and the use of a governor on the engine to maintain engine speed at a constant rate. Further control is furnished by providing a reverse current relay.

A male taper on the engine end of the armature shaft couples directly to a female taper machined in the end of the crankshaft. The armature shaft is hollow and a drawbolt passes through this arbor from the crankshaft to a nut at the outboard end of the armature shaft to lock the armature in position.

Large brushes and an oversize commutator assure long brush life and minimize internal losses of the generator. All the generator windings are impregnated with insulating varnish and are then baked to provide greatest possible protection against moisture. The frame is a rolled steel ring, machined on the inside, which bolts to the rear of the crankcase. Armature laminations are of 26 gauge silicon steel and pole piece laminations are of 22 gauge silicon steel.

The generator is air cooled by a blower at the engine end of the generator which draws air in through an opening in the rear housing, passing it over the brushes, commutator, armature, and field windings and then discharging it through vents in the crankcase casting. It will operate satisfactorily in up to a 500 Centigrade temperature rise and is radio shielded to prevent radio interference.

Self-excitation makes the generator completely independent of all outside sources of power. However, batteries must be connected to the generator to use it as a starting motor. In the event that there are no batteries sufficiently charged to start the engine, it can be started manually. A rope sheave is mounted on the blower end of the crankshaft and a starting rope is furnished with each unit.

CONTROLS

A control box is mounted on the top of the generator just to the rear of the engine. The starting switch is on the face of this box. A stop button, which stops the plant by grounding the primary circuit of the magneto when pressed, is mounted on the side of the engine blower housing. A filter for controlling radio suppression is mounted in a filter bracket located on the inner side of the front control panel. An ammeter just above the starter shows the generator charging rate, and terminals for the starting battery and for battery charging are located on the other side. A reverse current relay is mounted on the side of the control box opposite the livers.

This generator is designed primarily for use as a battery charger. However, regulation is so close that it can be satisfactorily used to operate small D.C. motors and appliances of the proper voltage range.

RADIO SUPPRESSION

The radiated radio noise shall not exceed 5 microvolts per meter three feet from the power unit. The conducted radio noise shall not exceed 5 microvolts when measured across the output terminals with a model 32A Ferris Instrument Co. noise meter or equivalent.

ACCESSORIES

A cranking rope, set of tools and instruction book are packed with each power

SPECIFICATIONS

ENGINE DETAILS

Engine - One cylinder, four cycle, L-head, air cooled, bore 2-1/4", stroke 2-1/4", compression 5 to 1, 2000 RPM, 1 HP, splash oil system. (Oil pump supplies oil to a trough reached by the connecting rod). The cylinders are separate from the crankcase. Helical cut timing gears.

Pistons - The aluminum 2-1/4" pistons have two compression rings and one oil ring.

Connecting Rods - The connecting rods are a special aluminum alloy casting and do not contain any bushings or babbit lining.

Oil Base - The oil base which serves as a mounting base, is removable. Oil capacity, 1 quart.

Oil Pump - The plunger type oil pump supplies pressure lubrication to the crankshaft and connecting rod bearings. When the plunger is forced down, the pressures force the lower steel ball down closing the inlet opening, thereby regulating the oil pressure.

Governor - The governor is of the ball type.

Valves - There are two valves, one intake and one exhaust. The valve springs are enclosed. The tappets are adjustable. Valve guides are cast iron and the intake valve guide is replaceable. The stellite valves are used when obtainable.

Ignition - The ignition is supplied by a flywheel type high-tension magneto designed to produce a high output voltage at low cranking speed. The entire ignition system is radio shielded.

Fuel System - The carburetor has an adjustable main jet and is very simple in function. Manual choking is employed. The air cleaner is of the dry type. The 3 gallon fuel tank mounted atop the generator is equipped with a fuel shut off valve and with a cap-vent which may be closed. The engine will operate satisfactorily on unleaded gasoline from 62 to 80 octane.

Cooling - The power unit is cooled by forced air from a centrifugal type blower mounted at the front end of the crankshaft. Air is drawn through a grilled opening at the center of a stamped housing and forced outward at a high velocity over the cylinders, cylinder heads, valve posts and valve guide enclosures. It is discharged upward so that it may be collected by a suitable shrouding and directed to free air if plant must be operated in a housing.

INSTALLATION

LOCATION - As this model unit is a portable type and frequently may be operated outdoors, select a place as free as possible from sand, mud and dust. Although the unit is protected against normal exposure, shelter it as much as practicable. Install in a room or enclosed mobile vehicle, if practicable. Avoid exposure to the elements.

Make sure that the wiring which connects the battery and lead to the power unit is large enough for the purpose. Make all connections tight. Use proper insulated wire or cable. **IMPORTANT** - To assure a proper degree of radio interference suppression, battery leads must be taped, tied, or laced, together for a distance of at least three feet from the power unit. Refer to the wiring diagram.

Use care when moving the power unit. Keep in an upright position when filled with fuel and oil. The power unit should set in an approximately level position while in use.

If another fuel tank is used make sure that the bottom of the tank is higher than the fuel inlet of the carburetor and that the highest level to which the tank may be filled, including any filler neck, is not more than 12" above the level of the carburetor inlet.

VENTILATION - Ventilation is very necessary to prevent serious damage due to overheating. Any gasoline engine develops heat which must be removed from the compartment in which the plant is operating.

Provide air inlets and outlets in the form of openings in the walls of the room or the vehicle. Normal air circulation is not sufficient; provide additional openings.

In cold weather close off part of these openings to restrict outside circulation. Then the heat generated by the plant will help to keep the room warm.

EXHAUST - The power unit is equipped with a muffler mounted on the engine. The muffler has a 1" O.D. steel tubing outlet. No extension is necessary for outdoor use.

If the power unit is to be used indoors, pipe the exhaust gases to the outside of the building in the following manner. Connect a 1" I.D flexible tube, at least 12 inches long to the exhaust outlet of the exhaust muffler. Add whatever additional piping is needed. The flexible tubing provides flexibility between the power unit and any rigid iron exhaust pipe extending to the outside of the building.

If the total exhaust extension exceeds 6 feet in length, increase the diameter one pipe size for each additional 10 feet, to avoid back pressure. For outdoor operation, no exhaust tubing need be connected to the muffler unless it is desired.

WARNING - Exhaust gases may cause serious illness and even DEATH. When the plant is to be operated indoors or within a closed vehicle, be sure all exhaust gases are piped outdoors. Keep all inflammable materials away from the exhaust line. Otherwise the high temperature of the exhaust line when the plant is operating may ignite such materials.

PREPARATION

PREPARATION FOR OPERATION

PRELIMINARY - Check to make sure that the instructions under **INSTALLATION** have been complied with.

Inspect the power unit to see that all visible parts are in proper place and undamaged. Recondition any damaged parts or replace with new parts before operating.

LUBRICATION - Remove the oil filler plug from the oil filler neck on the side of the crankcase. Fill the crankcase with one quart of clean engine oil of proper viscosity, pouring it through the oil filler neck. For external temperatures above 50° F., use SAE #20 oil; below 50° F. but above 0° F., use SAE #10; below 0° F. see the **COLD WEATHER OPERATION** instructions.

The oil level may be determined by removing the oil filler cap and looking into the oil filler neck. Always stop the plant before checking oil. The oil should be visible at all times.

The oil should be changed in a new plant after the first running-in period. In moderate temperatures this would be at the end of 50 operating hours.

Place a drop of oil on each moving part of the linkage between the governor arm and the carburetor throttle arm.

FUEL - A 3-quart tank is mounted on the plant. Remove the cap and fill the tank with gasoline. The plant will operate satisfactorily on 62 to 80 octane gasoline. Do not fill the tank entirely full of cold gasoline. Expansion of the fuel as it becomes warm may cause it to overflow and result in a fire.

Before starting the plant be sure to open both the vent in the fuel tank cap and the shut-off valve at the bottom of the tank.

NOTE: If it is necessary to use fuel containing lead, refer to subject **USE OF LEADED FUEL** under **ABNORMAL OPERATING CONDITIONS**.

GENERATOR BRUSHES - When the power unit is processed at the factory for export shipment. The generator brushes are pulled outward a short distance in their holders to prevent contact with the commutator or slip-ring. The brushes are held in such positions by placing the ends of the springs against the sides of the brushes.

Remove the generator end bell cover band which is held in place by two screws. Push each brush inward until it rests firmly against the commutator or slip-ring. Then place the end of the spring so that it rests firmly on the outer end of the brush. See that each brush is firmly held against the commutator or slip-ring by its spring. Replace the cover band and tighten its retaining screws.

CHARGE RATE ADJUSTMENT

The charge rate may be varied to the desired value by adjusting the governor adjusting nut. Turning the nut to increase the spring tension raises the speed, voltage and charging current. Decreasing the tension will have the reverse effect.

When the specific gravity of the battery electrolyte (acid) ceases to rise, or reaches 1.275, the battery will be fully charged and should therefore be disconnected from the power unit.

STARTING THE POWER UNIT

OPERATION

Make no attempt to start the power unit until instructions on the preceding page have been complied with, then make sure that both the vent in the fuel tank cap and the shut-off valve in the bottom of the tank are open.

The proper method of using the self-starting switch, located on the control panel, is to press the start button, holding it for a period of about five seconds and then releasing it. As this is being done partially close the choke, the amount depending on the temperature condition. When cold the choke must be in a nearly closed position to enable the engine to obtain a rich enough mixture. When warm, only light choking is necessary. If the plant does not start at the first attempt, due to lack of fuel, dirty conditions or for any other reason, repeat the process.

After the engine has started, continue to provide a rich mixture until it has warmed up. During the first few minutes, push the choke button inward gradually until the full open position is reached without the engine hunting because of too rich a mixture or sputtering from a mixture that is too lean.

EMERGENCY STARTING

In the event there are no starting batteries available, or the batteries on hand are too discharged to start the engine, the plant can be started manually.

Wind the starter rope around the pulley at the end of the generator in a counterclockwise manner. Then set choke closed on the carburetor and pull rope with a firm, even pressure. If plant should fail to start, open choke half way on succeeding tries until plant is started. These instructions will vary according to the temperature.

CONNECTING THE LOAD

When connecting the battery to the plant, make certain to connect the positive terminal of the battery to the positive terminal on the plant and the negative terminal of the battery to the negative terminal on the plant. When facing the two terminals on the control box, the positive terminal will be on the right side. Make certain that all connections are tight before cranking the power unit. Battery leads should be taped, tied, or laced, together for a distance of at least three feet from the power unit. (See wiring diagram.)

STOPPING THE POWER UNIT

Always disconnect the load before stopping the power unit. Stop the power unit by pressing the stop button located on the blower housing of the engine. This button cuts off the ignition and should be held in until the power unit completely stops running.

Stop the power unit for the last time before moving to a new location by closing the fuel shut-off valve beneath the fuel tank. The engine will run until most of the fuel is used from the carburetor. This will prevent spilling any fuel if the engine should be tipped while moving. This method of stopping the plant will also serve in an emergency if the power unit will not stop by pressing the stop button.

ABNORMAL OPERATING CONDITIONS

COLD WEATHER OPERATION

LUBRICATION - If the power unit is subjected to temperature of 0° F. or lower, diluted oil should be used in the crankcase for easier starting and satisfactory lubrication.

Run the power unit until the oil in the engine is warm. Omit this operation and the one immediately following when preparing a new power unit for operation the first time. Never run the power unit with the oil level below the oil filler neck. Drain the crankcase oil and replace the drain plug.

Thoroughly mix 1 qt. of SAE #10 or #10W oil with 1/5 pint of clean kerosene or a good grade of distillate if kerosene is not available. It is best to use SAE #10 or #10W oil for this mixture. SAE #20 oil may be used but is not recommended. Do not use a heavier grade as the mixture will separate each time the engine is stopped. This will defeat the purpose and may cause damage.

Fill the crankcase to the top of the oil filler neck with this diluted oil. Immediately start the power unit and allow to run for 10 minutes to distribute the mixture in the lubricating system.

When adding lubricant between drain periods, prepare a separate mixture. DO NOT add kerosene to the crankcase without first mixing with oil. Mix kerosene with SAE #10 or #10W oil in the above proportion and add as much of the mixture to the crankcase as is needed.

CAUTION! When the lubricant is diluted as above, it should be changed after every 50 hours of operation and should be checked more often.

HOT WEATHER OPERATION

Under extremely warm operating conditions make sure there is ample ventilation.

Cooling fins of the engine should be kept clean.

Keep the crankcase oil level near the top of the oil filler neck.

DUST AND DIRT

Under adverse dust and sand conditions it is necessary to check the unit and service it more often.

Keep the power unit as clean as possible.

See that the supplies of fuel and oil are kept in air tight containers.

Clean the air cleaner as often as is necessary. Check daily.

Clean the commutator and brushes often. See that brushes ride easily in the holders.

GENERAL SERVICE INFORMATION

The following periodic servicing outline should be followed to assure satisfactory service.

DAILY SERVICE

Check the following items daily:

OIL - Check the oil level in the oil filler neck every 8 operating hours, while the plant is not running. Add oil of proper viscosity, if needed to raise the oil level to the top of the oil filler neck. See LUBRICATION SECTION. Never operate the plant with the oil level lower than the bottom of the filler neck.

FUEL - Plants of this type will run about 5 hours per gallon of fuel, depending on the load. Refill the fuel tank often enough to assure a continuous supply of fuel.

AIR CLEANER - Remove the air cleaner tube and blow through screen to make certain that no dirt is clogging the mesh. Never remove air tube while plant is running.

WEEKLY SERVICE

Check the following items weekly or every 50 operating hours, whichever occurs first:

SPARK PLUGS - Remove the spark plug shield and the spark plug. Clean the spark plug and set the gap at .025" to .030". A defective spark plug should be replaced with a new one of correct type.

LUBRICATION - Place a drop of medium lubricating oil on the throttle control rod joints.

AIR CLEANER - Remove the air cleaner tube. Rinse thoroughly in kerosene or suitable solvent until all dirt is removed. Dry and then dip in lubricating oil, same as used in the engine. Allow surplus oil to drain completely and then replace.

The air cleaner should be serviced more frequently when plant is operated under dusty conditions.

MONTHLY SERVICE

Check the following items monthly or every 200 operating hours, whichever occurs first:

OIL - Drain the crankcase oil while warm. Replace the plug and refill with one quart of clean, new oil of proper viscosity.

IGNITION SYSTEM - Check the ignition by removing the cable connected to the spark plug. Push the electric starting button and hold loose cable within 1/4" of the spark plug terminal. The spark should jump the gap. If spark is obtained at this distance, replace wire. Should no spark result, refer to MAGNETO page.

FUEL SYSTEM - The combination fuel valve and screen should be removed from the fuel tank and the strainer screen cleaned.

CARBURETOR - Inspect the carburetor. Clean if necessary with a lint free cloth. Check the brushes for good seating contact, free fit in guides and uniform spring tension. If brushes are worn to 3/4" length or less, install new ones. New brushes must be properly fitted as shown in the CARBURETOR section.

ACCESSORY SERVICE

CARBURETOR

The carburetor is a Model 59B-3 Zenith. It is an adjustable type with a float to regulate level of the gasoline. It is designed for use with gasoline only. Most carburetor trouble is a result of dirty gasoline or water in the gasoline, so these should be the first things checked. This could cause uneven running or leaking of the carburetor, as the dirt might lodge under the float needle valve. If leaking persists after cleaning, it may be due to the float operation being sticky or the float needle valve being worn so as not to make a perfect seal. It is then necessary to replace both the needle and the seat. The float may be leaky and contain gasoline. If this is the case, replace with a new float.

CARBURETOR DISASSEMBLY. To remove the carburetor bowl, remove the two screws holding the bowl to the bowl cover. This will release the choke wire and the bowl. The adjusting needle may be removed by loosening the packing nut and then turning the needle in a clockwise direction. To remove the bowl cover from the cylinder, disconnect the fuel line and disconnect the throttle control link. The fuel valve, which is located in the bowl cover directly below the fuel line elbow, must then be removed so that the locknut holding the bowl cover to the cylinder may be unscrewed and the bowl removed. To reassemble, reverse procedure. When the carburetor has been reassembled, it will be necessary to adjust the main jet. This may be done by turning the jet needle clockwise until it fits lightly in its seat. Then, turn the needle counter-clockwise for two full turns and tighten the locknut.

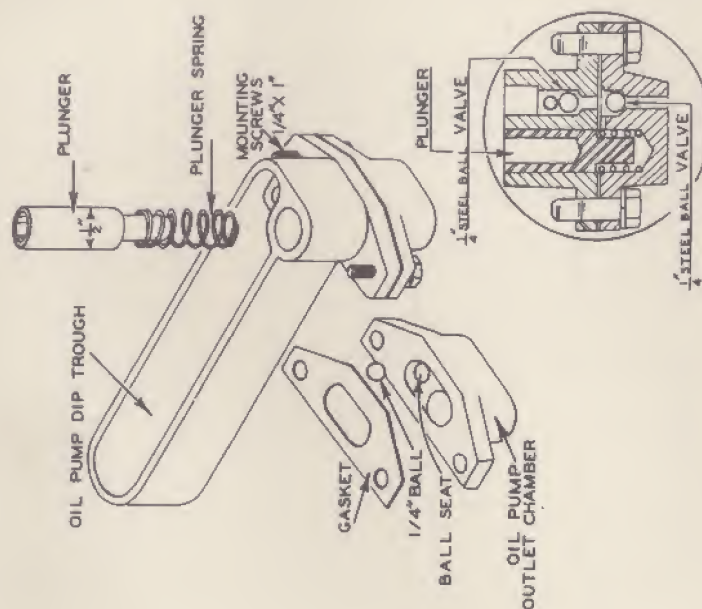
USE CLEAN TOOLS WHEN WORKING ON THE CARBURETOR. Also be sure they are in good condition. For example, a screwdriver might be worn uneven and cause damage to a jet. All jet holes are made quite small, and are made very exact, therefore should NEVER be cleaned with a wire or a drill or any other way than by blowing air through the holes. The main adjustable jet is adjusted best by running the plant near full load and closing the jet until the engine slows speed than carefully opening the jet a little at a time, until engine has picked up speed again. This will be the best spot for all-round operation.

THE CARBURETOR HAS NO STRAIN OR SCREEN. The gasoline is strained before it reaches the carburetor by a screen located on the end of the fitting screwed into the bottom of the gas tank. **THE SPEED OF THE ENGINE IS CONTROLLED BY THE THROTTLE OPENING,** and the throttle is in turn operated directly by the governor arm. If there is too much flutter or jerky motion of the governor arm, it will cause the throttle shaft to wear both itself and the body of the carburetor. Check the amount of wear in the body by using the unworn part of the throttle shaft as a gauge. Investigate the fluttering action of the governor arm, as it will soon wear out a new throttle shaft.

AIR CLEANER

The air cleaner is of the dry type and needs only periodic service. It is simply made up of a screen fitted diagonally into the air cleaner tube. The tube is fitted into an adaptor which is fastened onto the lower part of the carburetor by means of a round head machine screw. The meshed screen is designed to filter the air as it enters the carburetor. It may be cleaned by rinsing in kerosene. If the engine is run near a dusty location, clean the air cleaner more often by this method. A dirty air cleaner causes excessive fuel consumption, rapid cylinder and piston wear, and may prevent the plant from running.

OIL PUMP ASSEMBLY



An eccentric follower operates off the camshaft and drives a push rod which fits into the plunger illustrated above.

As the plunger rises due to action of the plunger spring, oil is taken in through the inlet and past the lower inlet steel ball valve.

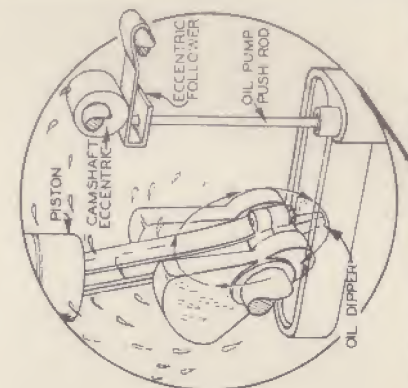
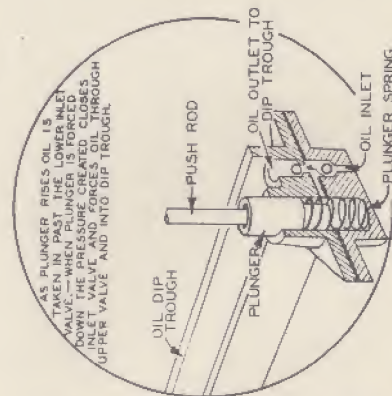
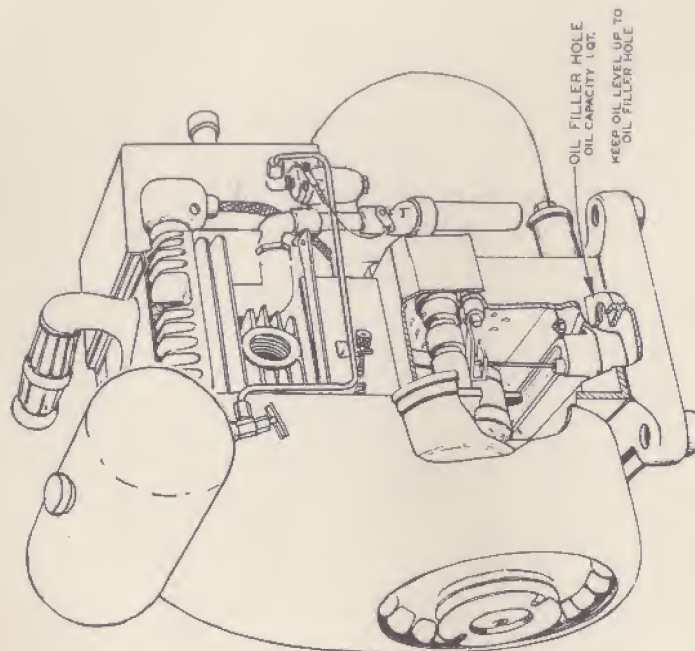
When the plunger is forced down, the pressures force the lower steel ball down closing the inlet opening. The oil in the chamber is forced up through the upper chamber past the upper steel ball valve into the oil pump dip trough.

From there it is splashed throughout the inside of the crankcase by the oil dipper on the end of the connecting rod bearing.

OILING SYSTEM

ALL POINTS IN THE ENGINE ARE LUBRICATED BY OIL BEING THROWN BY THE CONNECTING ROD WHICH DIPS INTO AN OIL TROUGH LOCATED IN ITS PATH. THIS TROUGH IS KEPT FILLED BY A PUMP LOCATED WITH ITS INLET AT THE BOTTOM OF THE ENGINE.

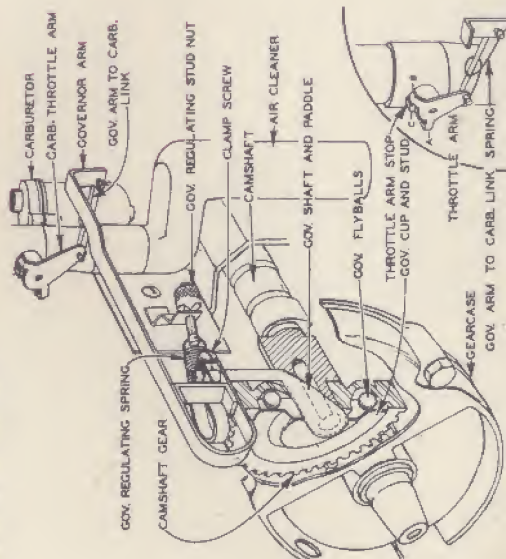
AS SKETCH BELOW ILLUSTRATES THE PUMP IS OPERATED FROM CAMSHAFT BY A FOLLOWER PIVOTED ON THE CRANKCASE AND WHICH IN TURN OPERATES ROD RESTING IN THE OIL PUMP PLUNGER.



OPERATION OF GOVERNOR

The purpose of the governor is to control the speed of the engine under various loads. When the plant is started, eight steel balls located in the camshaft gear, are moved by centrifugal force upon short inclines in the gear casting and forced against the governor cup. The cup, in turn, acts upon the paddle and shaft to which is connected the arm to the carburetor. A governor regulating spring is connected to the arm to balance this centrifugal force.

The tension on this spring is set to keep the plant running at the same speed, regardless of how much load is demanded. To INCREASE the speed or RAISE the voltage, the tension of the spring should be INCREASED. This is done by a screw adjustment on one end of the spring. The engine should be kept running at its rated speed for satisfactory results. See specification sheet for correct speed. All adjustments can be made with the spring.



If the governor is disassembled, or if the carburetor is removed from the engine, re-setting of the governor will be necessary as follows:

RE-ADJUSTING - The throttle arm should be in the idle position when the plant is not running. Then the throttle butterfly is correctly set and the ear B of the throttle arm rests against the throttle arm at C. When ear A rests against the stop C then the butterfly is in the wide open position and the plant is operating at full load.

If the governor arm has become loosened from the governor shaft, which extends from the front gearcase, the clamp holding the arm to the shaft should be loosened. With a screw driver inserted in the slot in the top of the governor shaft, turn the shaft clockwise (to the right) as far as possible, and hold it in that position. While the governor spring holds the arm in the normal idle position, retighten the clamp screw securely.

Be sure the governor arm to carburetor link spring is looped around link properly as shown in inset. This spring keeps a tight connection between throttle arm and governor arm which is very important to the operation of the Governor.

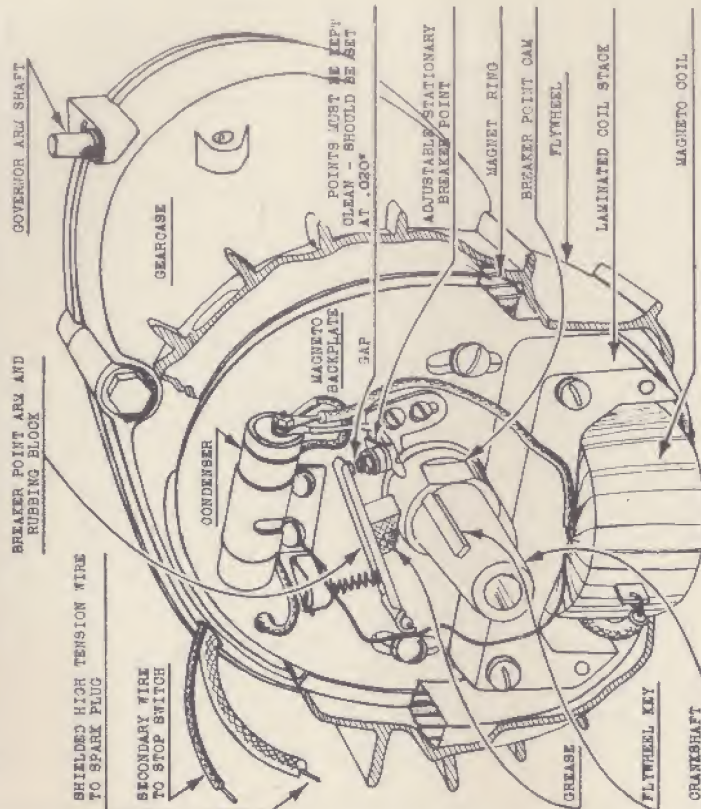
These operations will restore the governor to its original setting, and it should function properly.

MAGNETO

The internal parts of the Magneto, as shown in the sketch below, are reached by first removing the Blower Housing at the front of the Engine. The Flywheel is then removed by loosening the Hexagon Head Bolt holding it to the Crankshaft. Turn the Bolt out Two or Three Full Turns, and, while pulling forward on the Flywheel with one hand, strike the Head of the Bolt several sharp blows with a Heavy Hammer. When the Wheel has loosened from the Taper, turn the Bolt out and remove the Wheel.

ADJUSTING BREAKER POINTS

The Breaker Points should be spaced so that they open a maximum of .020". The Contact Faces should be Smooth and Free of Oil, as this would cause rapid contact wear and misfiring of the Engine. Proper Breaker Point Gap is obtained by loosening the Two Screws in the Adjustable Stationary Breaker Point Bracket and sliding it up or down until proper clearance is obtained. Then the Breaker Arm Rubbing Block is rubbed.



Block is worn so that it is no longer possible to obtain the correct clearance, a new Breaker Arm must be installed. It is desirable at this time to check the Breaker Point Tension which is measured by connecting a Spring Tension Gauge to the Point on the Breaker Arm, and pulling upward until the Point barely opens, then raising the reading from the Gauge. The correct tension is 23 ounces, or approximately 1-1/2 pounds. Each time the Points are adjusted, the Breaker Arm Rubbing Block and the Crankshaft Cam should be greased with a Lubricant of the Stat-up variety, that will not sling off of the shaft when the machine is worn. A Grease designed for this service, may be obtained from the factory.

HARD STARTING

Hard starting may be caused by a wide Gap or collection of a Lead compound on the Spark Plug Electrodes from the use of Ethyl Gasoline. The Lead deposit acts as an insulator and a higher than normal voltage will be required to jump the Spark Plug Gap. Clean and Set Plug Points. By far the most frequent cause of Hard Starting is the use of Oil that is too heavy, which prevents the Engine from being cranked at a high enough speed to obtain a good spark.

WEAK SPARK

The Spark from the Magneto can be checked by removing the High Tension Wire from the Plug and holding the Terminal about 3/16" from a metal part on the Engine while someone pulls the Engine over with the Rope Starter. If the Spark is weak or very short, it may be caused by a Short Circuit on the Stop Wire Line, Incorrect Breaker Point Gap, Leaky Condenser, or a Defective Coil.

NO SPARK

Causes of failure of the Magneto to produce any Spark are: Shorted Condenser, Breaker Points not Opening, Primary Wiring Grounded or Shorted, or a Breakdown of Insulation in the High Tension side of the Coil. Trouble of this nature will require replacement of the Defective Unit.

At the end of a year or after about 2500 hours of service, the plant should be given a thorough going over including inspection of pistons, rings, valves, etc.

VALVES

This engine is a four cycle engine and has two automotive type valves located in the cylinder, one an intake valve which uses the cylinder proper as a seat, the second the exhaust valve, which uses a special inserted ring in the cylinder as a seat. The valves are operated by tappets riding on the camshaft, and are adjusted by screws in the end of the tappets to a clearance of .008" on the intake valve and .008" on the exhaust valve.

The valve timing is determined by the correct meshing of the crankshaft gear and the camshaft gear. On each gear will be found a mark. These marks must match to give the correct valve timing.

To grind the valves, it is necessary to remove the cylinder head and valve tappet cover on the front of the cylinder. The valve spring washers must then be raised high enough to remove the lock pins in the valve stem, which will then allow the valves to be pulled up and out of the cylinder. Before removing the valves, turn the crankshaft until the valves are in a closed position when the piston is at the top of the explosion stroke. Then turn the tappet screw down to allow plenty of clearance between the ends of the valves and the screws while grinding the valves. This procedure makes it possible to service the valves without removing the cylinder from the engine.

If the valves or valve seats are burned uneven or pitted, it will be necessary to have them resurfaced with a resurfacing tool, as the ordinary method of lap-grinding will not produce a true surface.

When valve surfaces are refinished, replace the valves in the cylinder, after cleaning cylinder of all carbon.

Make sure that the valves are put back in the cylinder in the same location as they were in before servicing. Make sure that valves move freely in the cylinder before reassembling. If they are sticky in the guides, make sure the stems are clean and ream out the carbon in the cylinder guides. NEVER ASSEMBLE IF THE VALVES WON'T FALL OF THEIR OWN WEIGHT IN THE GUIDES.

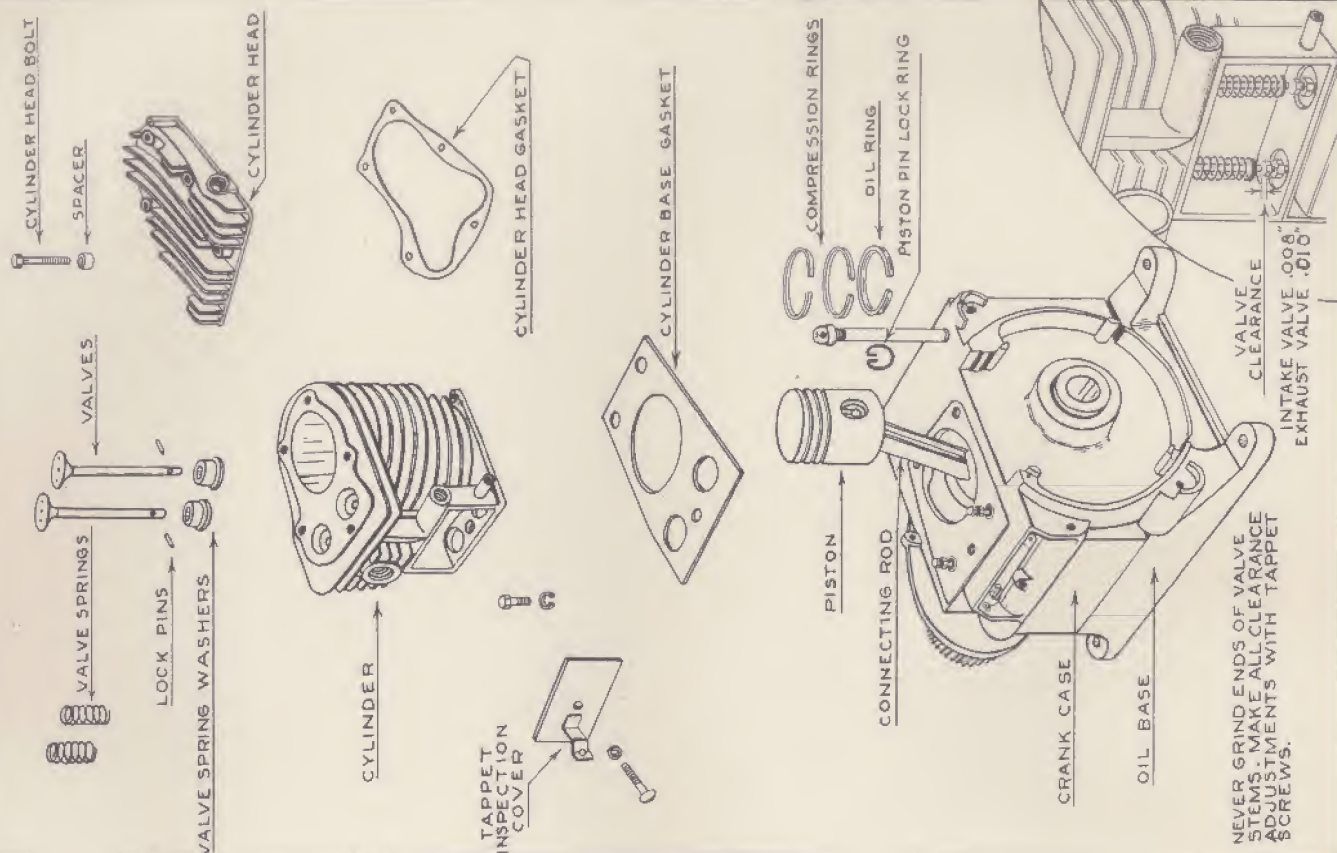
Raise the valve washers and insert the lock pins in the valve stem. Make sure that the washers come down over both ends of the pins to avoid having the pins drop out. These small pins are made of hardened steel, and if lost, must be replaced with a hard steel pin of equal strength.

Never grind the end of the valve stems. Make all clearance adjustments with the tappet screws. Should the exhaust valve seat become cracked, or for some reason have to be replaced, this can be done by returning the cylinder to the factory.

After adjusting the valve tappet screw, be sure to tighten the lock nuts securely. If possible, use a thickness gauge having a blade of .008" when adjusting valve tappet clearance.

CYLINDER & VALVE SERVICE SHEET

SKETCH ON THIS SHEET SHOWS ENGINE ASSEMBLY WITH AIR HOUSING, BLOWER HOUSING ETC., REMOVED. - THESE PARTS MUST BE REMOVED BEFORE ANY CYLINDER SERVICING CAN BE DONE.



NEVER GRIND ENDS OF VALVE STEMS. MAKE ALL CLEARANCE ADJUSTMENTS WITH TAPPET SCREWS.

PISTON AND PISTON RINGS

The piston of this engine is a $2\frac{1}{4}$ " aluminum piston specially made for this light plant, and can be supplied by the manufacturer. It has two compression rings and one oil ring. The piston pin is fitted to a hand push fit in the piston when it is at room temperature (70° to 100° F). It is fitted into the connecting rod a hand push fit at room temperature (70° F). The pin is held in by a spring lock ring at each end which is fitted into a groove in the piston. Be sure these are in place when assembling. The piston size is 2.244", and the cylinder size is 2.250". Should the cylinder be scored for any reason, it can be bored or honed to a standard oversize dimension of .005" - .010" - .025" oversize, depending on the amount necessary to clean up. Piston and rings can be furnished by the manufacturer in these oversizes.

The piston can be removed by first removing the cylinder. Bring the piston to the top of its stroke when cylinder is removed, and wrap a clean cloth around the connecting rod, large enough to prevent losing the piston pin lock rings in the crankcase while removing them. Rings can be left on the piston. Piston should be heated until the pin can be pushed out by hand. NEVER FORCE PIN OUT BY HAMMERING, as the connecting rod may be bent. Remember it is made of aluminum. Piston should be heated also when installing. This can be done by heating the piston in hot water. Piston will not rust, as it is made of aluminum. Remember to put in piston pin lock rings. Compression Rings and oil ring can be removed by spreading them just enough to slide them off the piston. When installing new rings, be sure they are free in the grooves of the piston. Be sure oil ring is clean, and oil holes in piston are open. Check rings for correct diameter by pushing them into the cylinder squarely and seeing that the ends are apart at least .015". Use oil freely and keep parts clean when reassembling.

CONNECTING ROD

The connecting rod of this engine is a special aluminum alloy casting and does NOT contain any bushings or babbitt lining. The piston pin hole is $5/8$ " diameter and the crankpin hole is reamed to d.1265" to 1.127". The crankpin bearing is cut in half, and the lower half or cap is bolted to the rod by two cap screws. Two oil holes are drilled in the large bearing end, and one in the top of the rod for lubricating the piston pin. Connecting rod cap has a projection cast as part of the cap which dips into the oil trough and sprays the crankcase with oil. Should it be necessary to replace the piston pin they can be furnished in standard oversizes of .002" and .005", which makes it possible to save the connecting rod by simply reaming it oversize. Should the large bearing of the connecting rod be scored however, it would be necessary to replace the rod with a standard new one.

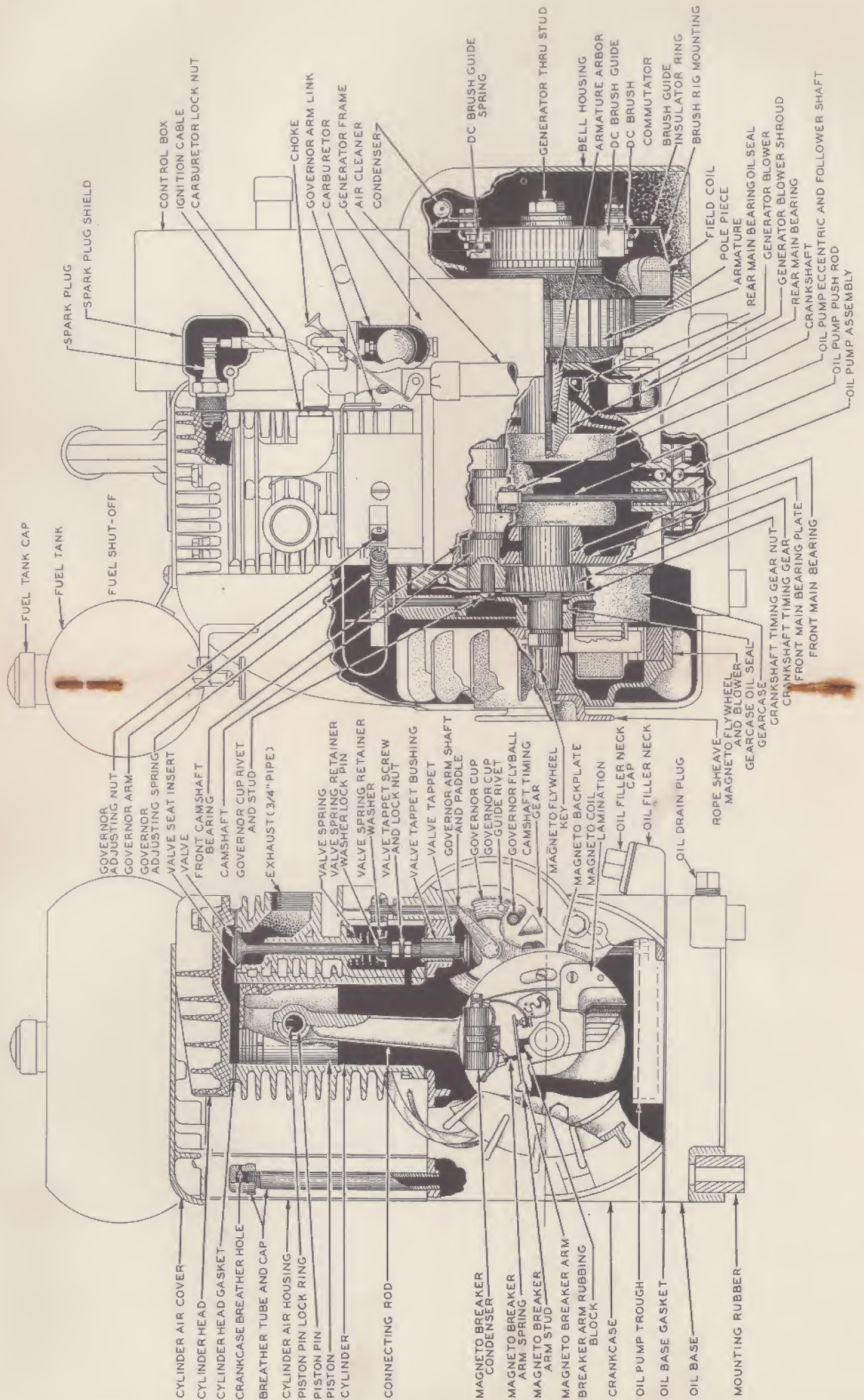
BEARINGS

The main bearing, as well as the camshaft bearings of this engine, are steel backed babbitt lined. They are pressed into the crankcase and the bearing plate and are then line reamed. These bearings can be replaced, but great care is required. When a new bearing is received, it can be used to push out the old as it is being pressed in. WHEN THE BEARING HAS A HOLE, BE SURE IT IS LINED UP WITH THE CORRESPONDING HOLE IN THE CRANKCASE OR BEARING PLATE. New bearings always have to be reamed AFTER being pressed into place. It is the best practice to push the bearings in with the use of an arbor press, but if this is not available, they can be tapped in with a block of steel or hard wood and a hammer. USE MODERATE FORCE. When the crankshaft and camshaft are standard diameter, the bearings should be reamed to .0015" to .002" over standard. Check the work carefully and be sure no shavings or dirt is left in the engine.

The tappet bearings are made of bronze and are pressed into the crankcase. These also have to be reamed AFTER pressing into place. They should be reamed to a size just large enough to allow the tappets to drop by their own weight. When fitting engine running parts, be generous with oil, as you make the final assembly. NEVER FIT BEARINGS SO TIGHT THAT THE ENGINE CANNOT BE TURNED OVER BY HAND. All fits must be made RUNNING fits or the bearings will burn and score. Be sure bearings do not project beyond finished surfaces. The generator has no bearing as the armature is supported entirely by the engine crankshaft.

OIL SEALS

An oil seal is pressed into the crankcase between the engine and the generator to prevent oil from leaking out around the crankshaft. Should it ever become necessary to replace the oil seal, first remove the old oil seal by using a small chisel or screwdriver and pry outward, thereby raising the edge of the oil seal so that it may be gotten hold of with a vise type pliers and pulling outward. It may be necessary to chisel all around the seal to break it loose from its fit but being very careful not to damage the crankshaft. When fitting in a new seal, cover the seal with lubricating oil and fit the leather or composition over the crankshaft evenly so that there are no folds or edges and that the seal is not damaged in any way. Tap the oil seal into the crankcase by placing a solid wood or metal bar over the seal and rap sharply, making sure that the seal is fit solidly into place.



GENERAL

The generator includes two major assemblies; the armature, which is the stationary part of the generator and is a steel ring with four pole shoes and four field coils bolted inside. The brush rig assembly is also a part of the generator frame assembly, and it is not necessary to separate the two when removing the generator.

ARMATURE

The armature has no bearings. It is made up of a stock of perforated discs, referred to as laminations, which is pressed on a shaft tapered on one end. Wire is wound on this stock and the ends are connected to copper bars assembled together called the commutator and pressed on the shaft after the stack. This is the assembly of the direct current armature.

COMMUTATOR

The commutator should maintain a smooth surface. This surface does not retain its bright, newly-machined color in service but soon becomes a "mahogany" color. This is a normal condition and no attempt should be made by frequent sanding to retain a newly-machined appearance. Each bar of the commutator is insulated with mica from adjacent bars. After the commutator surface has been machined, the mica is undercut 1/32" below the machined surface. In service the commutator will eventually wear down and it becomes necessary again to undercut the mica.

The mica wears more slowly than the copper and if allowed to project above the surface, will interfere with proper seating of the brushes. This, in turn, will cause sparking and overheating and may burn the commutator bars to the extent that it will be necessary to remove the armature and refinish the commutator surface in a turning lathe. Ordinarily, the commutator requires only an occasional wiping with a dry, lintless cloth. Use no lubricant.

If blackening of commutator bars occurs and grows worse, the cause should be determined and eliminated. Blackening of bars indicates incorrect brush positions, poor brush contact or a rough, eccentric commutator. A badly burned bar or group of bars, accompanied by flashing when operating under a load, indicates an open circuit in the armature. This difficulty will require the attention of a competent armature repair man.

TESTING THE ARMATURE WINDING FOR GROUNDS

To test the winding, first disconnect the battery, then raise all the brushes off the commutator. Place one end of the test lamp wire on the commutator and the other end on the nut on the armature stud. If the bulb lights, the winding is grounded. In this case, consult a competent wind shop or replace the armature.

FIELD COILS

Field coils are form wound and connected together. Four are used in the generator and are held in place by the four pole shoes, which in turn are held in place by bolts through the generator frame. The field coils have been impregnated in a special insulating varnish and baked in an oven until the varnish has baked dry, insuring good insulation. Field coils in any motor or generator are subject to expansion and contraction caused by the normal heat of operation. This action over a long period of time may cause a wearing at some point on the field coils. A short of the field coils to either the generator frame or pole shoes would result. This can be corrected by location of the trouble and taping the coil at this point.

If a short has occurred inside the field coil, it cannot be repaired, and the coil must be replaced with a new one. A short inside a field coil can best be located by a temperature analysis. While the plant is running, compare the temperatures of all the coils by feeling the generator frame at each coil location. One location much colder than the other three would indicate a shorted coil at this point. Before testing the coil circuit, disconnect the leads on the brush rig. Test by using a light in series with a current as from a battery. Touch one end of the test wire to a field lead and the other to the generator frame, and if the light burns the coils are grounded.

POLE SHOES

Pole Shoes are made up of laminations of special electrical steel stacked and riveted together. After the riveting operation, they are drilled and tapped for the mounting screw holes which hold them to the generator frame. It is necessary to remove the pole shoes to remove the field coils, and if this has been done, be sure to check the inside of the generator frame and the contact surfaces of the pole shoes to make sure there is no dirt on these surfaces. It is necessary that a clearance of .012 to .014 of an inch be maintained between the pole shoes when assembled in the generator frame and the revolving armature. Any dirt between the pole shoes and the frame might harm the generator. Tighten the pole shoe bolts very firmly to keep them from coming loose.

Always turn the crankshaft on the plant after having done any assembly work such as this, before starting the plant to make sure that everything is clear. Never try to force start a plant against resistance such as lack of clearance, as much harm can be done.

GENERATOR SERVICE

BRUSH RIG

The brush rig assembly includes a black composition ring supported by four slotted brackets on the back of the generator. This rig supports the brushes and brush guides. The brackets are slotted so that the brush rig can be adjusted to the best position. This position is located at the factory and a chisel mark covered with yellow paint is put on the generator frame. These should always match. If they do not match, the brushes will arc, and also the generator will not develop the correct voltage.

BRUSHES are of a special material and must be supplied by the factory or an authorized agent for replacement. The brushes should never be oiled, as oil will form a sticky compound between brushes and the guides and cause the brushes to stick in the guides. Brushes should be replaced before they become so short that the springs will not keep them on the commutator.

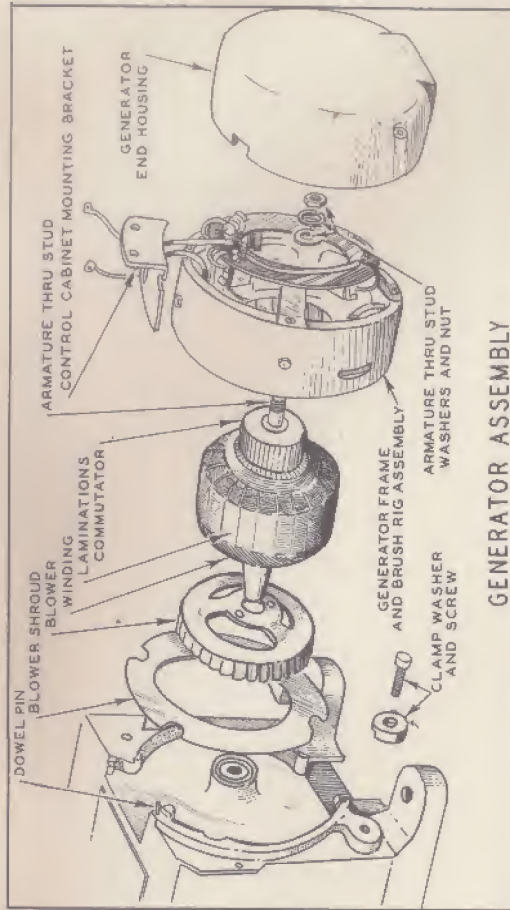
Be sure that brushes are always in the guides with the wire side of the brush on the same side as the slot in the guide. Brush spring tension should not be changed. When it is necessary to remove the generator from the engine, always pull the brushes up in the guides until the springs rest against their sides, and hold them up. This will prevent breaking the brushes.

Brushes must move freely in holder when spring tension is removed. Holders must set squarely with brush ring. Brushes must seat well on the commutator. Replace with new brushes those worn to approximately $\frac{5}{8}$ " length. Spring tension should be from 14 to 16 oz. when tested with end of spring just even with the outer end of the brush holder. Install new springs, if needed.

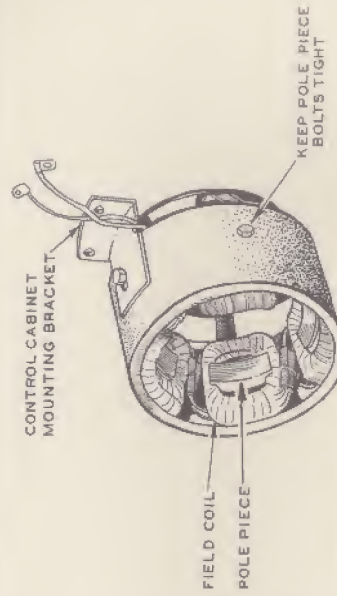
An extra set of brushes should be kept on hand. If necessary to replace, they must be sanded to seat properly on the commutator. Provide several strips of number 00 sandpaper about 10-1/2" long. The strips should be 3/4" wide. Two or three feet of scotch tape will be required. Remove the fuel tank from the plant. Lift all brushes high in holders and place ends of springs in such position as to hold them high.

Lay a strip of sandpaper on the bench, sanded side up. Take a piece of scotch tape, same width as sandpaper and about 3-1/2" long, and stick it on one end of sandpaper. Now take this sandpaper with tape attached and feed it on to the commutator in the direction in which the plant normally rotates. This should be done in such manner that the tape may be pressed against, and will adhere to, the commutator. Crank the plant slowly and feed the paper carefully so that it will be pulled entirely around the commutator, sanded side out.

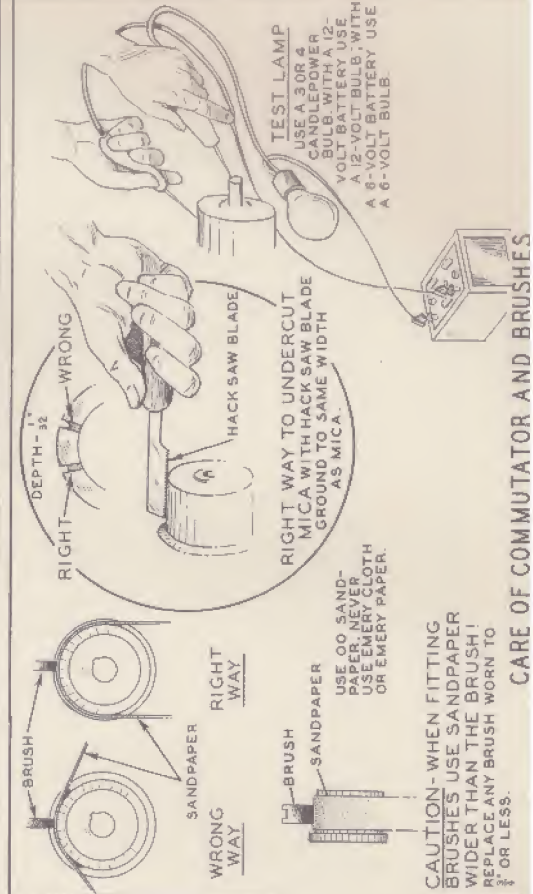
Release brushes so they rest on sandpaper with normal spring tension. Crank plant until brushes are sanded to proper seats. Examine each brush every few revolutions and sand no more than necessary to produce proper seats. If necessary, renew the sandpaper. Remove sandpaper and tape, blow away the dust, put brushes in holders and complete the plant assembly.



GENERATOR ASSEMBLY



GENERATOR FRAME AND FIELD COIL ASSEMBLY



CARE OF COMMUTATOR AND BRUSHES

DISASSEMBLY

To disassemble the generator from the engine, the frame must be removed first. It is NOT necessary to take off anything mounted on top of the generator, as they will come off with the frame if disconnected from the engine. The frame is held to the engine by two bolts and two heavy iron washers. The washers rest in grooves cut in the generator frame and act as clamps. These are all that hold the frame to the engine. It is necessary that the generator frame be in the right position and this is done by a steel pin pressed into the engine crankcase and a hole in the edge of the generator frame which receives the pin when the generator is bolted to the engine. Always be sure to pull the commutator brushes up in their guides before removing or replacing the frame, or they may catch on the armature and break off.

The armature is tapered on the engine end and fits into the crankshaft of the engine, and is fastened by a stud through its center, which is screwed tightly into the engine crankshaft. A nut and washer hold the armature to the stud. Because of the taper fit of the armature into the crankshaft, they often stick to each other after the nut on the outer end of the stud is loosened. The best procedure in removing the armature is to loosen the nut until it is flush with the end of the stud and then strike the nut a sharp blow using a hammer and a block of wood which will loosen the tapered fit. Then take the nut and washer off (leave the stud) and pull the armature off over the stud. When reassembling make sure that the tapered end of the armature and the tapered hole in the crankshaft are clean. Always handle parts carefully, as it is very easy to damage an electrical part, especially an armature.

CONTROL PANEL

Disconnect the Battery and consult the Wiring Diagram before working on the control panel.

This electric plant is equipped with a simple electrical control system which makes it possible to start the plant by using the battery for cranking, and also controls the charging circuit somewhat in the same manner as a cut-out on the automobile generator.

It must be remembered, however, should trouble develop, that the controls are dependent on the battery (and on the generator in some cases) for good operation. Make sure your trouble is not elsewhere (such as a low battery or poor battery connections) before attempting any work on the controls.

The purpose of the controls on this plant are only two in number. The first is to make it possible to start this electric plant by pushing a button or switch. The second is to control the charging current from the generator to the battery. These purposes and the necessary wiring and control construction are clearly shown on the wiring diagram provided with this book.

The controls are connected to the generator by wires made long enough to allow the cabinet to be inspected without disconnecting the wires. Handle with care and use no force.

The controls have one reverse current relay. (A relay is a switch operated by an electrical current). The relay is made up of a "U" shaped frame in which a coil of wire is mounted around an iron core. A contact blade, the same width as the frame, is pivoted on one leg of the frame above the coil. The contact blade is held in an "up" position by a spring on its pivot end. The other end of the spring is hooked to a small clip which is riveted to the relay frame. This spring and its correct tension is a very important factor in the good operation of the relay. If any work is done on the relay, such as replacement of a part, avoid stretching the spring or bending the clip to which it is hooked.

Keep the contacts clean with a lint free cloth. If the contacts are pitted, clean them with 00 sandpaper. Do not use a file or emery cloth. If they are badly pitted check to see if the wiring is correct and the load not too great for the rating of the plant. Replace the contact.

Keep the battery in good condition and well charged to avoid trouble in the controls. It is possible (if the plant has been started often with a weak battery) that the contact points on the relay will arc or flash. This will burn the points and prevent good contact. This action is compared to that of the points in a magneto or automobile distributor. A weak or low battery causes this because there is too little current to pull the contact blade down with a strong snappy action. This action is necessary when making an electrical contact of this kind.

The generator is the cranking motor of this plant, and the current necessary to crank the generator must pass through the control system.

AVOID TROUBLE BY DISCONNECTING THE BATTERY BEFORE WORKING ON THE PLANT.

GENERAL TROUBLE CHART

GENERATOR

1. Plant runs but generator produces no current.
 - A. Open line wire or switch.
 - B. Blown fuses.
 - C. Brushes not seated correctly.
 - D. Brushes worn.
 - E. Brush springs without tension.
 - F. Dirty commutator or collector rings.
 - G. Incorrect or loose wiring in panel.
 - H. Defective reverse current relay.
 - I. Defective line condenser.
2. Low Voltage and Power.
 - A. All of above points.
 - B. Defective field coil.
 - C. Low engine speed.
3. Generator will not crank plant.
 - A. Discharged batteries.
 - B. Loose or dirty connections.
 - C. Defective Start Switch.
 - D. Poor Brush operation.
 - E. Engine will not turn over.

BATTERY

Keep connections tight and water level above the separators in the battery. Refer to battery manufacturers manual for complete handling instructions.

GENERAL TROUBLE CHART

ENGINE

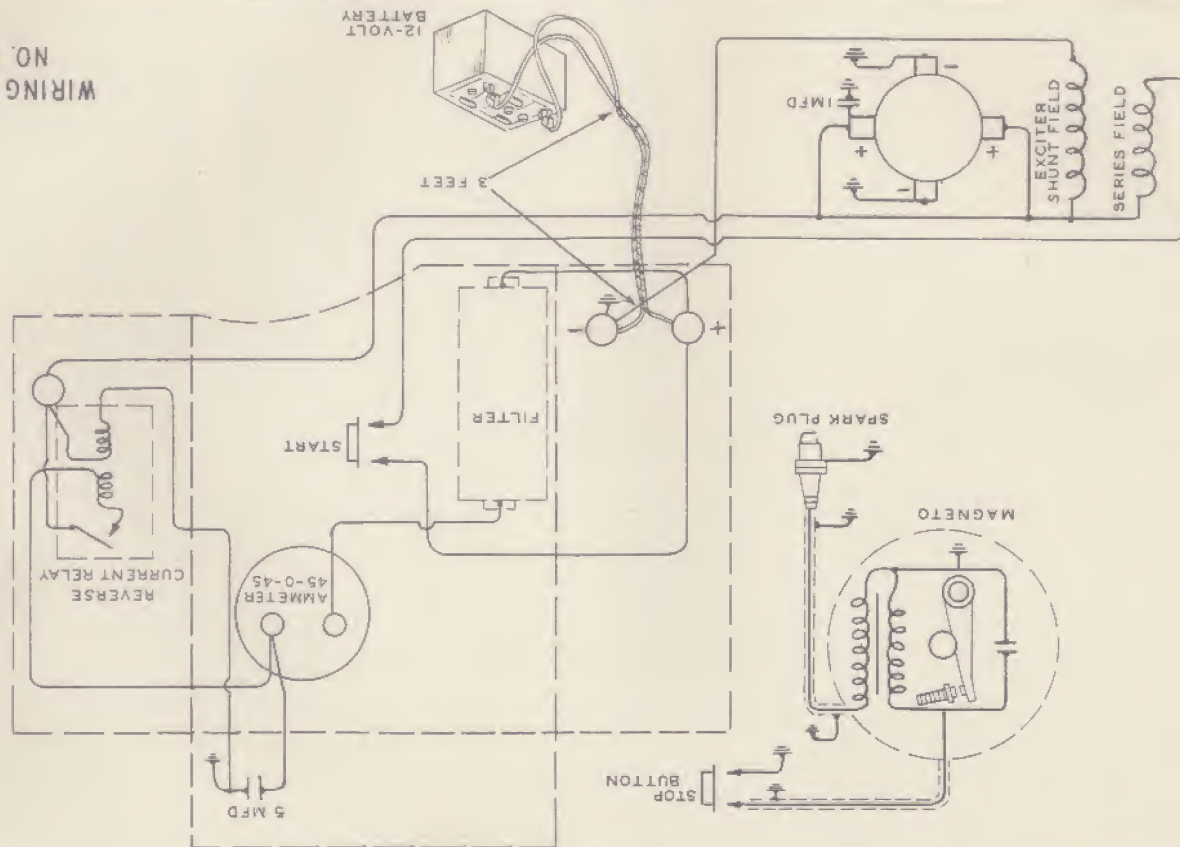
See that all wiring is properly installed and that the plant has been serviced with the proper grade of fuel and oil before checking further.

(See Accessory and Service Pages)

1. Plant fails to start or is hard to start.
 - A. Lubricating oil too heavy or too much used.
 - B. Poor grade of fuel used - Stale gasoline.
 - C. Clogged fuel line or clogged strainer in fuel tank.
 - D. Improper fuel mixture or dirty carburetor.
 - E. Carburetor choked or air cleaner clogged.
 - F. Defective ignition system - check spark plugs and test spark.
 - G. Discharged battery or poor connection.
2. Lack of Power or Uneven Running.
 - A. Check all points listed above.
 - B. Loose cylinder head - Blown gasket.
 - C. Overheating of engine.
 - D. Valves need adjusting or grinding.
 - E. Worn Piston Rings.
3. Plant Runs too Hot - Overheated.
 - A. Poor grade of fuel
 - B. Improper fuel mixture.
 - C. Generator is overloaded.
 - D. Incorrect timing.
 - E. Incorrect Lubricating oil.
 - F. Insufficient ventilation.
 - G. Dirty Engine - cylinder and blower.
 - H. Clogged or small exhaust line.
4. Plant Uses too Much Oil.
 - A. Incorrect grade of oil.
 - B. Insufficient or too much oil.
 - C. Oil not changed often enough.
 - D. Worn Piston Rings.
 - E. Overheating of Engine.
5. Noise

ALWAYS INVESTIGATE ANY UNUSUAL NOISES IN THE PLANT. Knocks are usually due to too much clearance at points like bearings and piston pin or connecting rod. First investigate for oil level. If level is right, check for carbon in cylinder. UNDER NO CONDITION RUN THE PLANT WITHOUT CORRECTING CONDITION for the damage may develop into more serious trouble.

WIRING DIAGRAM
NO. 81009



INSTRUCTIONS FOR ORDERING PARTS FROM FACTORY

If these instructions are followed when ordering parts, it will greatly speed up the handling of your order, and help us in rendering prompt and efficient service.

Be sure to state the MODEL NO. _____ SERIAL NO. _____ and GENERATOR NO. _____ of the particular ONAN PLANT for which parts are required. These numbers will be found on the name plate on the plant. Parts must be ordered by part numbers and description as listed in catalog. Do not order parts in sets unless so cataloged. State the exact quantity of each part needed. State definite shipping instructions on your order - Parcel Post, Express or Freight.

If in doubt as to the part number or description, send the part to us by Parcel Post. Print your name and address plainly on the package so that it can be identified when received. All parts will be held until a letter of advice is received.

Write, stating the part or parts that are being returned and the purpose for the return, regardless of any previous correspondence. Glue the letter (which must bear a three cent stamp) to the outside of the package. Do not seal package.

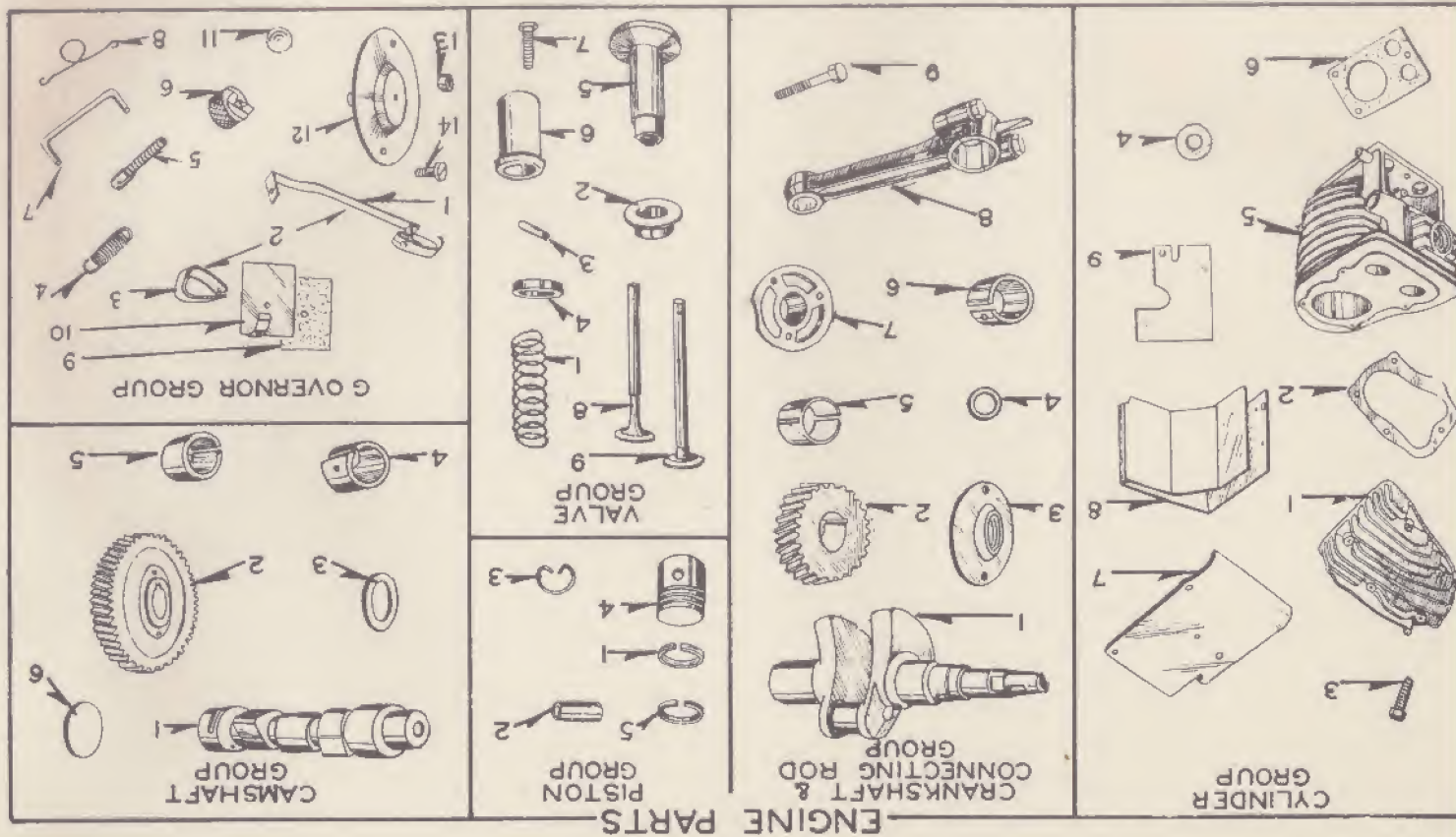
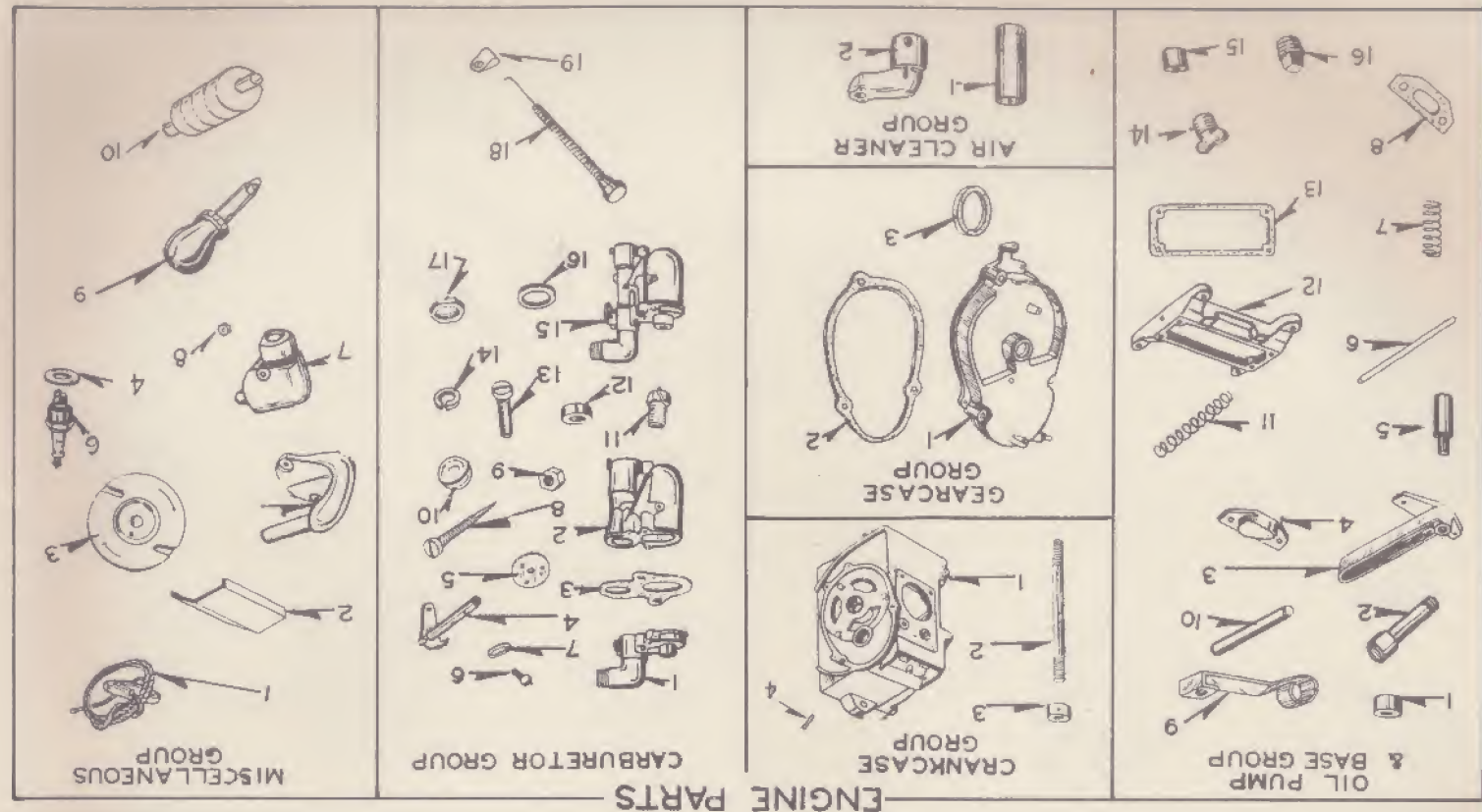
Please do not order parts in a letter in which some other subject is treated.

Send parts order to D. W. ONAN & SONS, addressing your letter as follows:

D. W. ONAN & SONS
43-51 ROYALSTON AVE.
MINNEAPOLIS 5, MINN.

All shipments are complete, properly packed and in good order when delivered to the transportation company. When a damaged shipment is received, claims should be filed immediately against the transportation company from which shipment has been received. All claims for shortages or errors in packing must be made immediately upon receipt of shipment, and must be accompanied by the original invoice or packing slip with the proper notation of damage or shortage signed by the transportation company at destination.

Parts prices quoted herein are F.O.B. factory.



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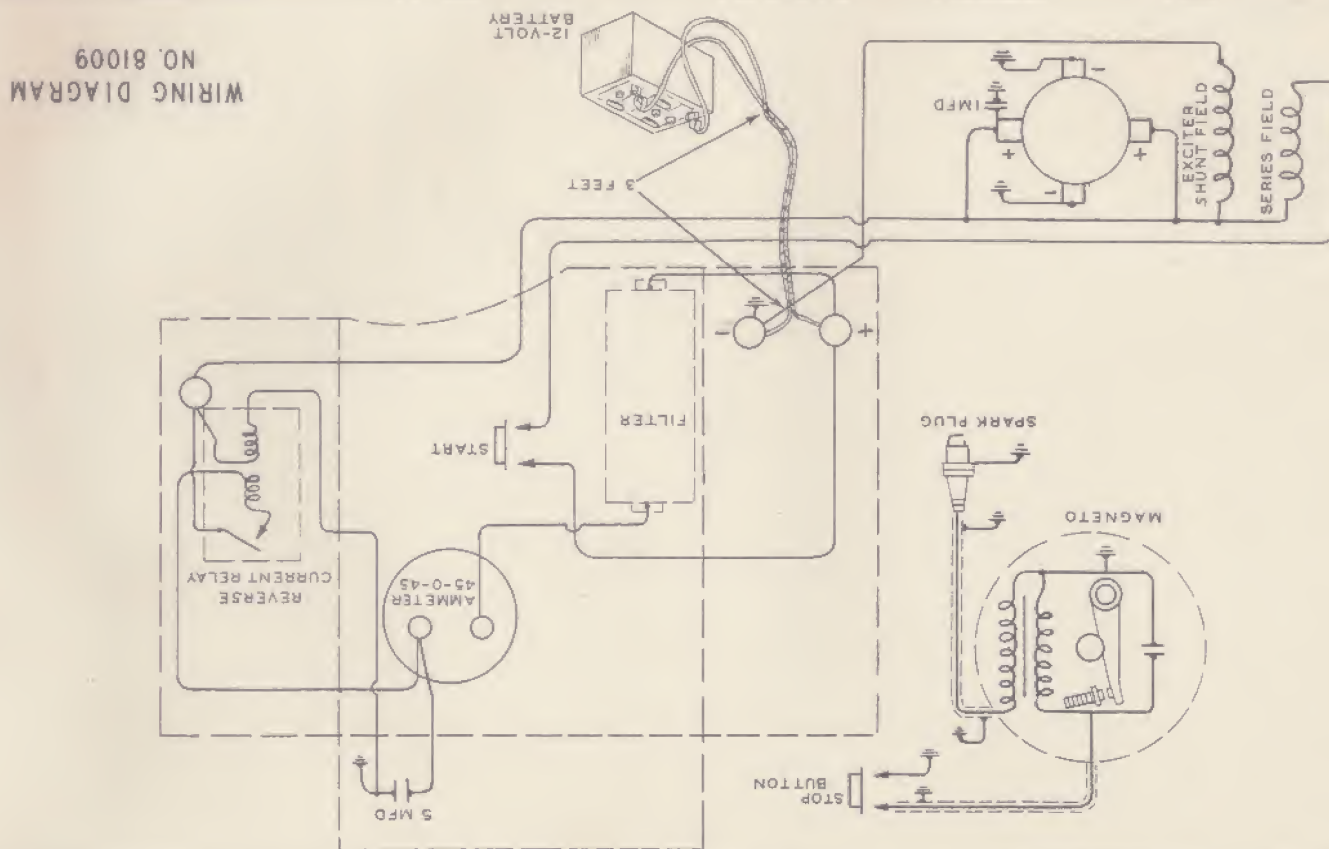
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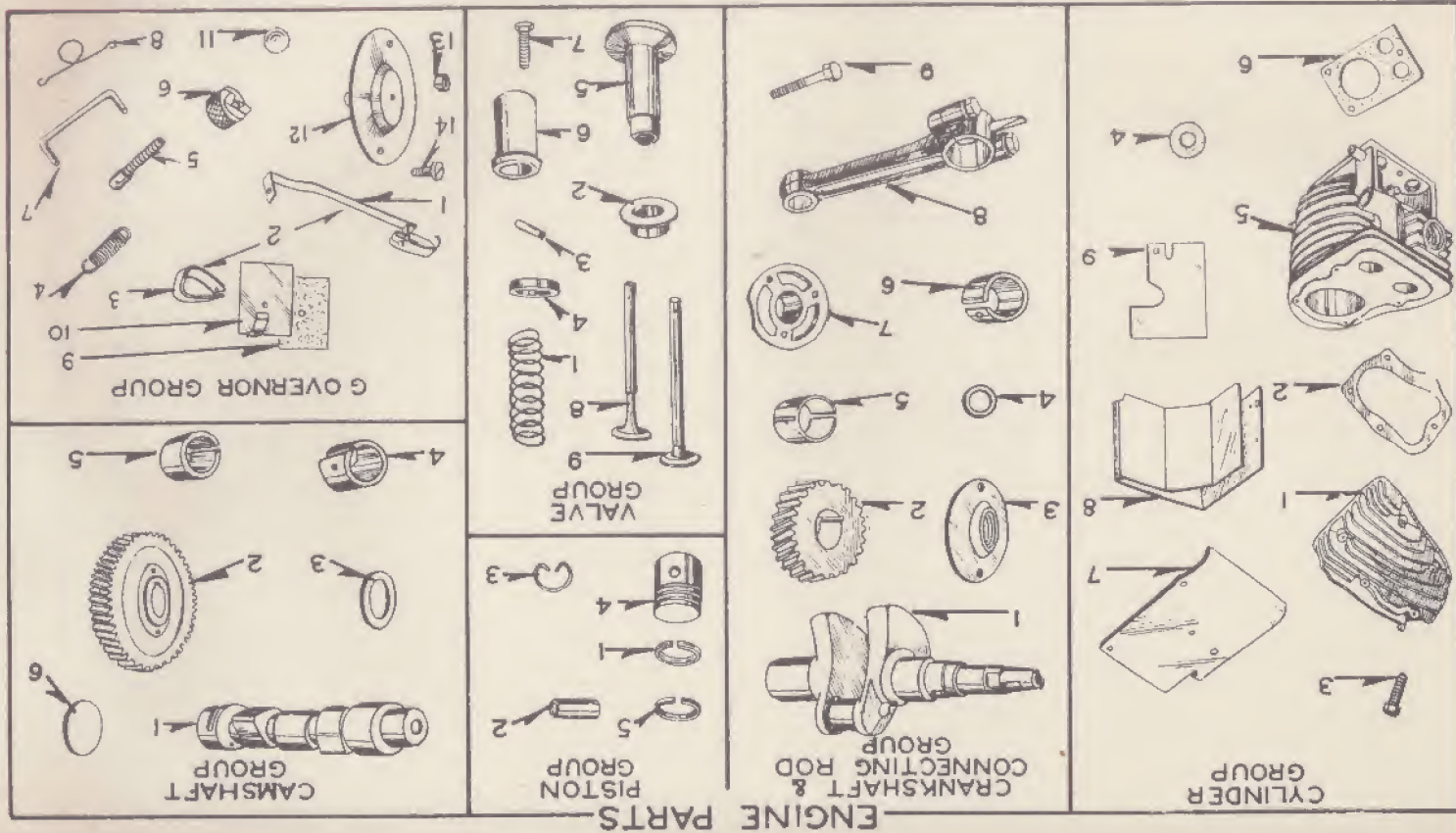
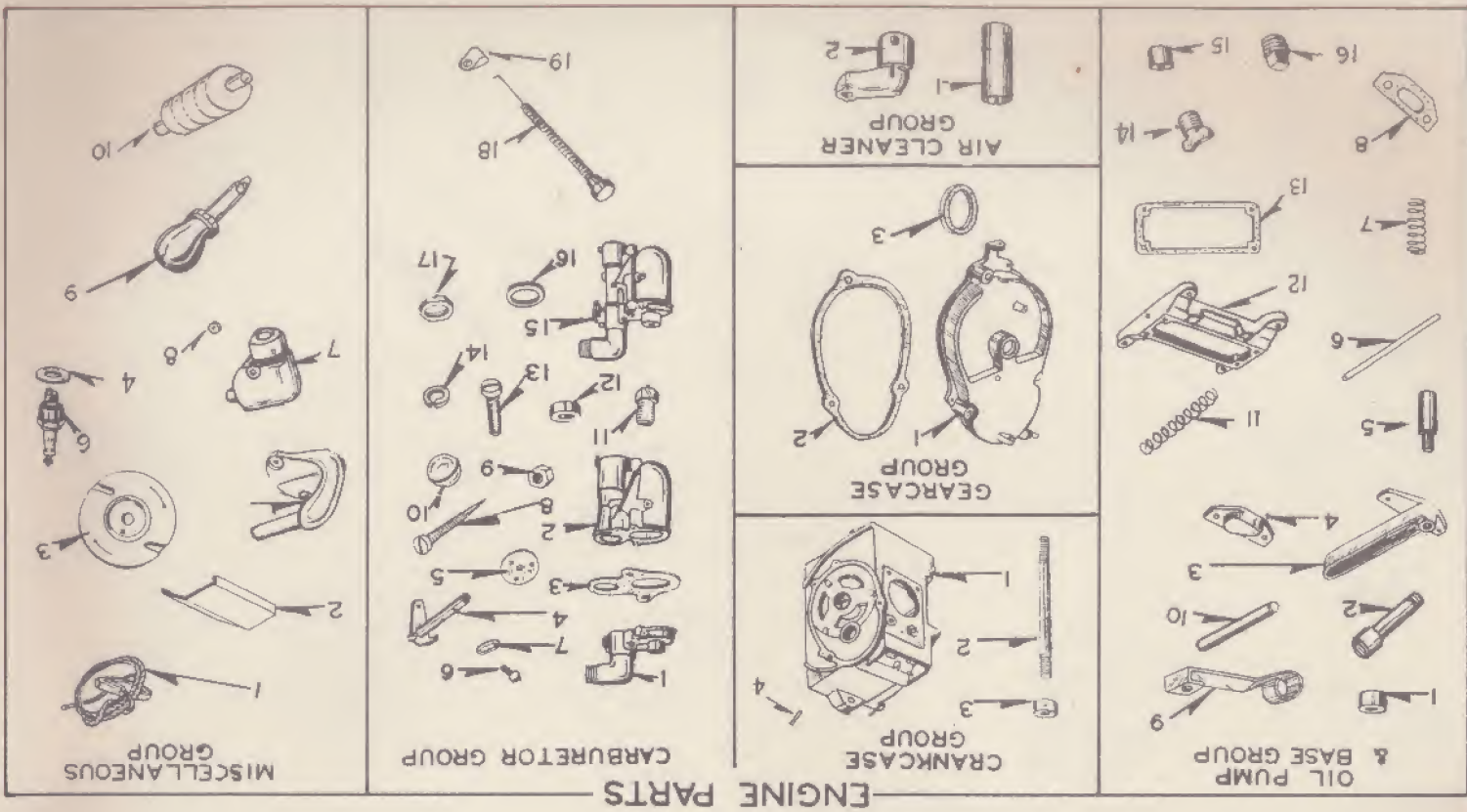
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43-51 ROYALSTON AVE.
MINNEAPOLIS 5, MINN.

All shipments are complete, properly packed and in good order when delivered to the transportation company. When a damaged shipment is received, claims should be filed immediately against the transportation company from which shipment has been received. All claims for shortages or errors in packing must be made immediately upon receipt of shipment, and must be accompanied by the original invoice or packing slip with the proper notation of damage or shortage signed by the transportation company at destination.

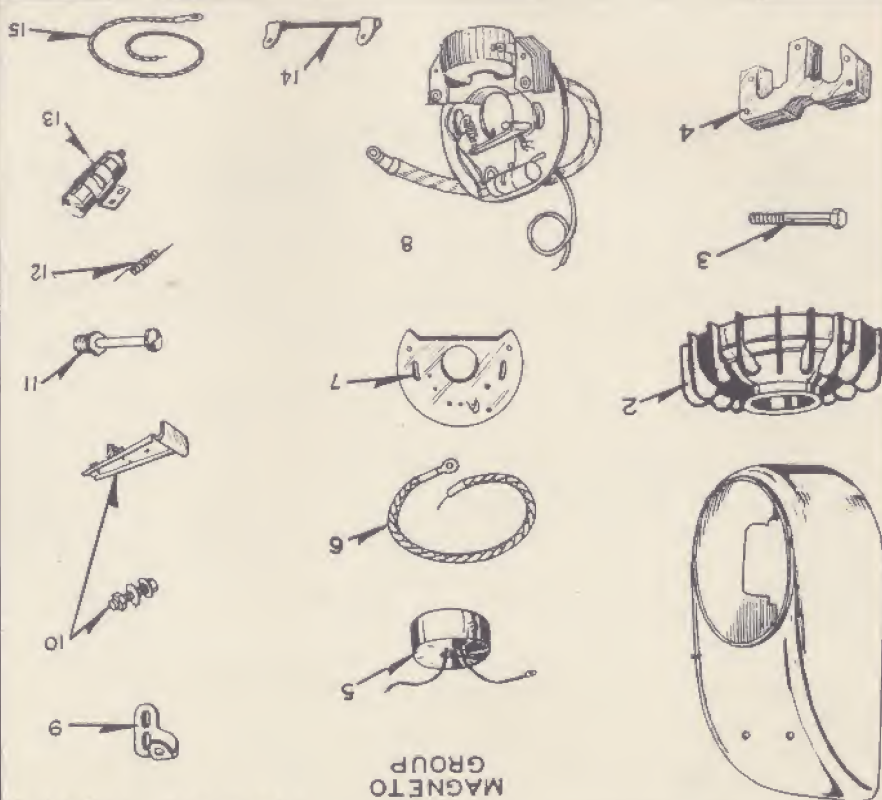
Parts prices quoted herein are F.O.B. factory.



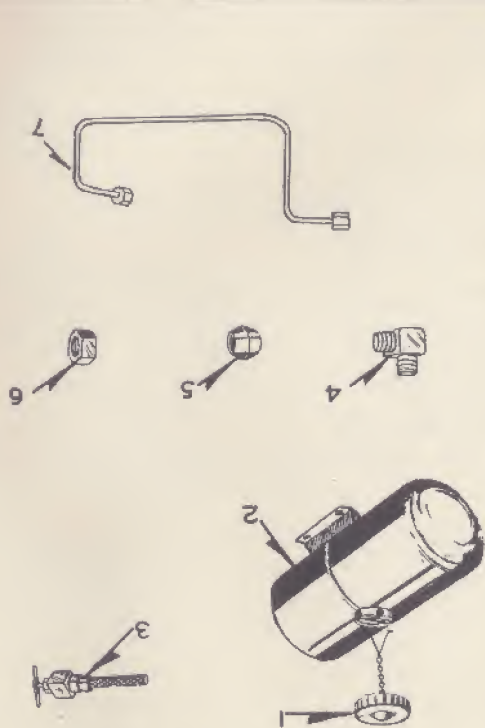


ENGINE PARTS

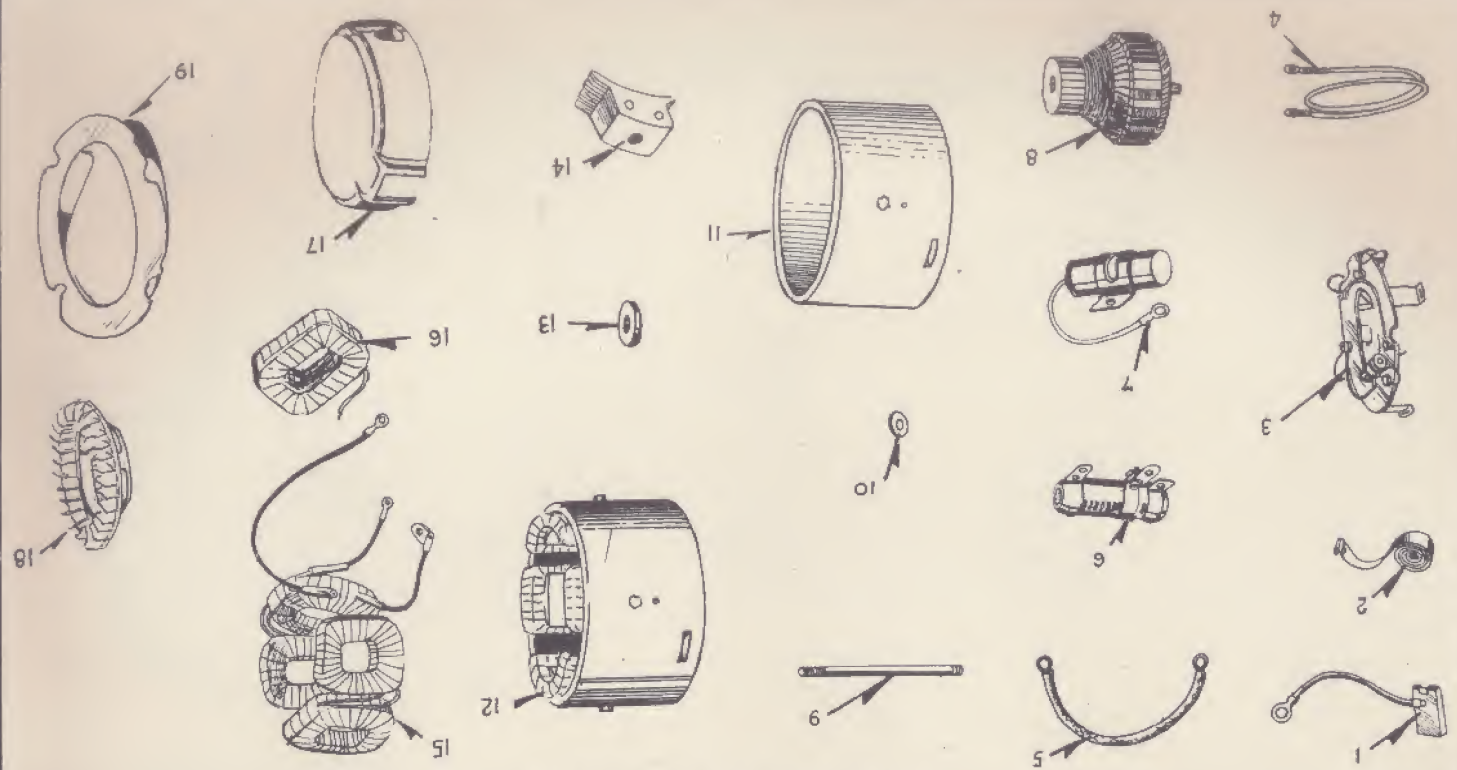
MAGNETO GROUP



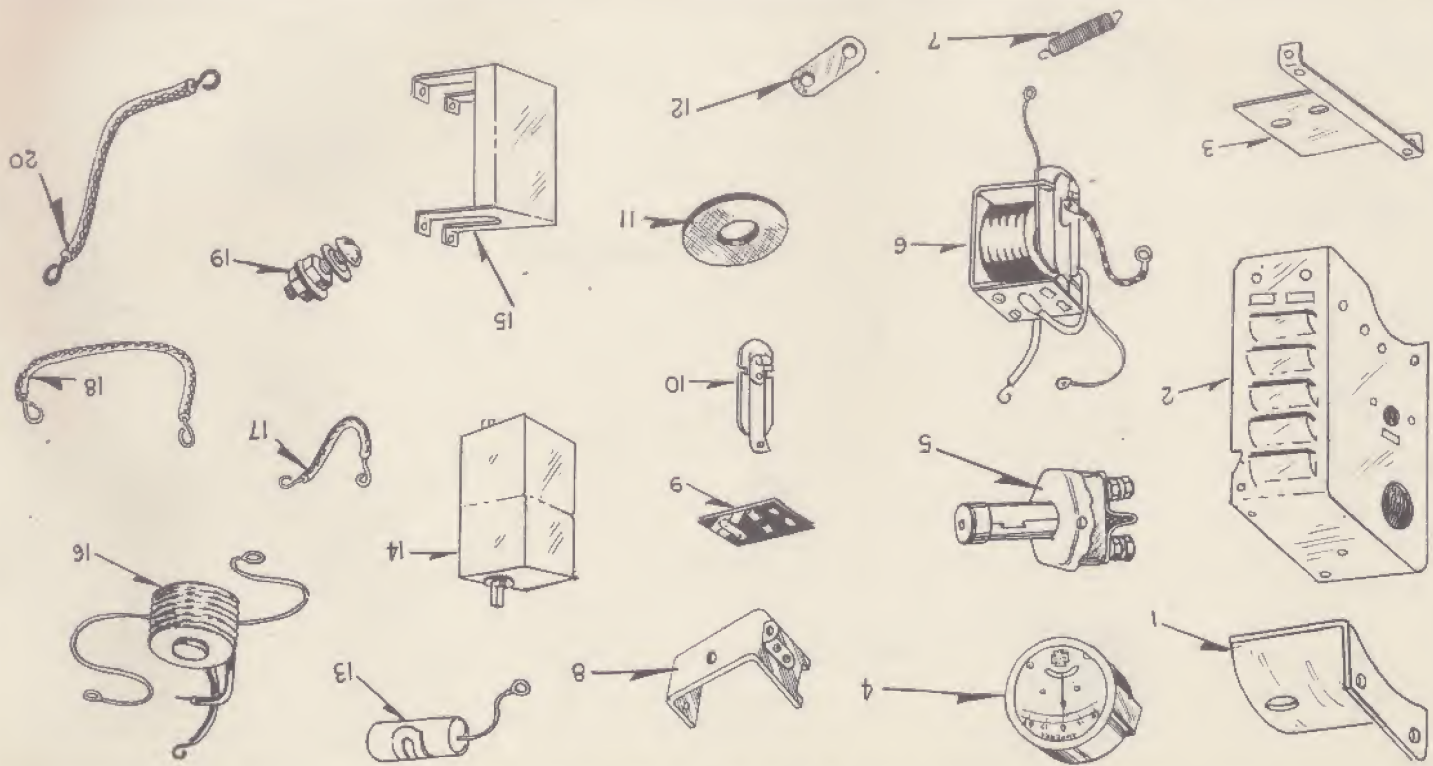
FUEL SUPPLY GROUP



GENERATOR PARTS



CONTROL PARTS



PARTS LIST			PRICE	
REF. NO.	QUAN. USED	DESCRIPTION	PART NO.	EACH
CYLINDER GROUP (See Page 30.)				
1	1	Head, Cylinder.....	8075	2.50
1	1	Gasket, Cylinder Head.....	8076	.25
3	5	Screw, Hex. Hd. - Cylinder Head.....	8077	.10
4	5	Spacer, Cylinder Head Bolt.....	8078	.05
5	1	Cylinder with regular exhaust valve seat (Specify).....	8080	9.00
		with Stellite exhaust valve seat (Specify).....		10.00
6	1	Gasket, Cylinder Base.....	8081	.15
7	1	Cover, Cylinder Air.....	8115	.85
8	1	Housing, Cylinder Air.....	8122	.75
9	1	Flag, Air Discharge.....	8117	.30
5	5	Screw, Hex. Hd. - 5/16" x 1/2"-18 - Cyl. Head.....		.05
3	3	Screw, Hex. Hd. - 3/8" x 1"-18 - Cyl. Base to Carb.....		.02
3	3	Washer, Lock - 3/8" - Heavy - Cyl. Base to Carb.....		.01
1	1	Screw, Hd. Hd. Mach. - 1/4"-20 x 3/8" - Cyl. Air Discharge Flag.....		.01
1	1	Washer, Lock - 1/4" - Cyl. Air Discharge Flag.....		.01
1	1	Screw, Binder Hd. - #10-32 x 5/16" - Cylinder Air Housing.....		.01
CRANKSHAFT & CONNECTING ROD GROUP (See Page 30.)				
1	1	Crankshaft.....	8000	6.00
1	1	Gear, Crankshaft Timing - Steel.....	8001	3.00
1	1	Nut, Crankshaft Timing Gear - Brass.....	8002	.60
4	1	Seal, Crankshaft Rear Oil - #50163.....	8007	.60
5	1	Bearing, Crankshaft Main - Front.....	8010	.90
6	1	Bearing, Crankshaft Main - Rear.....	8011	.60
7	1	Plate, Front Bearing - Cast Iron.....	8013	1.75
1	1	Rod, Connecting - Assy. Incl. Bolts - Aluminum.....	8017A	3.00
2	2	Bolt, Connecting Rod.....	8019	.10
3	3	Screw, Hex. Hd. Mach. - 5/16" x 5/8"-18 - Bearing Plate - Front.....	10317	.01
3	3	Washer, Lock - 5/16" - Light - Brg. Plate - Front.....	10601	.01
2	2	Screw, Hex. Hd. - 1/4"-20 x 1-1/4"-#3135 - Conn. Rod.....	8019	.01
2	2	Washer, Plain - 1/4" x 9/32" I.D. x 9/16" O.D. - Connecting Rod.....	19221	.01
2	2	Washer, Lock - 1/4" x 3/32" I.D. x 1/16" O.D. - Connecting Rod.....	10600	.01
PISTON GROUP (See Page 30.)				
1	1	Ring, Piston - Oil - 3/16" x 2-1/4".....	535	.50
2	1	Pin, Piston - 5/8".....	536	.35
3	2	Ring, Piston Pin Lock.....	537	.05
4	1	Piston & Pin - Assembly.....	8021B	3.25
4	1	Piston - Aluminum.....	8021	2.90
2	2	Ring, Piston - 3/32" x 2-1/4".....	8024	.25
1	1	Screw, Hex. Hd. Mach. - 1/4"-20 x 1-3/8"-18 - Tappet Cover.....		.02
1	1	Washer, Copper - 1/4" - Tappet Cover.....	10625	.02
2	2	Screw, Hex. Hd. Mach. - 1/4" x 3/4"-24 - Valve Tappet.....	8037	.10
1	1	Ring, Piston Set.....	79454	1.00
				35

PARTS LIST			REF.	QUAN.	PRICE
NO.	PART NO.	DESCRIPTION	USED	NO.	EACH
VALVE GROUP (See Page 30.)					
1	8030	Spring, Valve.....		1	.15
2	8031-1	Washer, Valve Spring Retainer.....		2	.10
3	8032	Pin, Lock - 3/32" x 1/2" - Valve Spring.....		1	.05
4	* 8033	Insert, Exhaust Valve Seat.....		3	.50
4	* 18034	Insert, Exhaust Valve Seat - Stellite Faced.....		1	1.70
5	8035	Tappet, Valve.....		4	.80
6	8036	Bushing, Valve Tappet.....		5	.50
7	8037	Screw, Valve Tappet - 1/4" x 7/16".....		6	.10
8	* 19029	Valve, Exhaust.....		7	.75
8	* 18029	Valve, Exhaust - Stellite Faced.....		8	2.25
9	19030	Valve, Intake.....		9	.75
10	8034	Gasket, Valve Inspection Plate.....		10	.10
2		Nut, Lock - 1/4"-28 - Hardened - Tappet.....		11	.05
1		Screw, Rd. Hd. Mach. - 1/4"-20 x 1-1/2" - Valve Cover Plate.....		12	.01
1		Washer, Plain - 1/32" x 17/64" x 7/64" - Copper - Valve Cover Plate.....		13	.02
CAMSHAFT GROUP (See Page 30.)					
1	8038	Camshaft.....		1	2.75
2	8073	Gear, Camshaft - Cast Iron.....		1	3.50
3	8042	Washer, Camshaft Spacer.....		1	.10
4	8047	Bearing, Camshaft - Front.....		1	.50
5	8048	Bearing, Camshaft - Rear.....		1	.50
6	8049	Plug, Camshaft Hubbard.....		1	.05
GOVERNOR GROUP (See Page 30.)					
1	8050	Arm, Governor.....		1	.20
2	8050A	Arm, Governor Assembly.....		1	.35
3	8050B	Bracket, Governor Arm & Spring.....		1	.35
4	8051	Spring, Governor Regulator.....		1	.10
5	8057	Stud, Governor Adjusting Spring.....		1	.10
6	8058	Nut, Governor Adjusting - #10-32 - Steel.....		1	.10
7	8059	Link, Connecting - Governor Arm to Carburetor.....		1	.10
8	8059-1	Spring, Governor Link Lock.....		1	.10
9	8084	Gasket, Gov. Spring Brkt. & Tappet Cover.....		1	.10
10	8085-A	Bracket, Governor Spring and Tappet Cover Assy.....		1	.40
11	19114	Flyball - 3/8" - Governor.....		16	.10
12	19119A	Cup, Governor Assembly.....		1	.75
13	19118	Spacer, Governor Cup - Plain - 1/32" I.D. x 3/64" - Governor Cup.....		2	.05
14		Screw, Binder Hd. - #6-32 x 5/8" - Governor Cup Stop Screw.....		2	.01
1		Screw, Socket Hd. - #10-32 x 3/4" - Gov. Arm.....		1	.01
1		Washer, Governor Arm - Heavy.....		1	.01
OIL PUMP AND BASE GROUP (See Page 31.)					
4	726	Cushion, Mounting - Upper.....		4	.15
2	730A	Nipple, Oil Drain and Coupling.....		1	.19
1	8060A	Pump, Oil Assembly - Not Illustrated.....		1	1.50
3	8061	Trough, Oil Pump Dip.....		1	.50
4	8062	Chamber, Oil Pump Inlet.....		1	.40
5	8063	Plunger Oil Pump.....		1	.25
6	8064	Rod, Oil Pump Push.....		1	.15
7	8065	Spring, Oil Pump.....		1	.10
8	8066	Gasket, Oil Pump.....		1	.05
9	8067	Follower, Oil Pump Cam.....		1	.30
10	8068	Shaft, Eccentric Follow.....		1	.25
11	8072	Spring, Oil Pump Follower Reatiner.....		1	.20
12	8100	Base, Oil.....		1	2.25
13	8101	Gasket, Oil Base.....		1	.10
14	8102	Plug - 3/8" - Oil Fill - Wing Pipe Plug.....		1	.30
15	8920	Cushion, Mounting - 1" x 1-1/4" x 3/8" I.D. Lower		4	.20
16	10702	Plug, Pipe - 3/8" - Oil Drain.....		1	.10
1	10003	Bolt, Hex. Hd. - 1/4"-20 x 1" - Oil Pump Mtg.....		2	.05
2	10600	Washer, Lock - 1/4" - Heavy - Oil Pump Mounting.....		1	.05
4	10029	Screw, Hex. Hd. - 3/8" x 3/4"-18 - Oil Base.....		4	.05
4	10627	Washer, Plain - 3/8" x 25/64" I.D. x 9/16" O.D. - Copper - Oil Base.....		4	.05
CRANKCASE GROUP (See Page 31.)					
1	8090BA	Crankcase, Assembly - Includes Bearings, Bearing Plate, Hubbeard Plug, Dowel Pin & Tappet plate		1	18.00
2	8092	Tube, Crankcase Breather.....		1	.15
3	8093	Cap, Crankcase Breather Tube - 1/8" - Pipe Cap.....		1	.10
4	1037	Pin, Dowel - 1/16" x 3/64" - Crankcase.....		3	.05
3		Screw, Hex. Hd. - 5/16"-18 x 3/4" - Brg. Plate.....		3	.02
GEARCASE GROUP (See Page 31.)					
1	8125A	Gearcase - Includes Governor Shaft & Paddle.....		1	3.50
2	8126	Gasket, Gearcase.....		1	.25
3	8127	Seal, Oil - Gearcase.....		1	.20
3		Screw, Hex. Hd. Cap - 5/16" x 1-1/2" - Gearcase Cover.....		3	.03
3		Washer, Plain - 1/16" - 21/64 I.D. x 9/16" O.D. - Copper - Gearcase Cover.....		3	.01
4	8052	Shaft, Governor.....		1	.35
AIR CLEANER GROUP (See Page 31.)					
1	8950A	Cleaner, Air - Assembly - Includes Screen.....		1	.75
2	8951	Adapter, Air Cleaner.....		1	.40
1		Screw, Rd. Hd. Mach. - #8-36 x 1/2" - Air Cleaner Adapter to Carburetor.....		1	.01
1		Screw, Rd. Hd. Mach. - #8-36 x 3/8" - Adapter.....		1	.01
1		Washer, Lock - 5/64" O.D. x 3/64" I.D. - Adapter.....		1	.01
1		Washer, Plain - 1/32" I.D. x 3/8" O.D. - Adapter.....		1	.01

*Use Stellite faced exhaust valve (and exhaust valve seat if needed) if mark "EX-STL" appears on part name plate or on head of original valve, or if mark "S" is stamped near valve seat. May be used to replace parts

*Use Stellite faced exhaust valve (and exhaust valve seat if needed) if mark "EX-STL" appears on plant name plate or on head of original valve, or if mark "NS" is stamped near valve seat. May be used to replace parts #8033 and #19029.

PARTS LIST			PRICE EACH	
REF. NO.	PART NO.	DESCRIPTION	QUAN. USED	PRICE EACH
CARBURETOR GROUP (See Page 31.)				
1	8880	Body, Carburetor - Upper - Zenith #C2-32.....	1	2.50
1	8881	Body, Carburetor - Lower - Zenith #C3-25A.....	1	2.00
2	8882	Gasket, Carburetor Body - Zenith #C142-12.....	1	.10
3	8883	Shaft, Throttle - Incl. Lever - Zenith #C29-16....	1	.60
4	8884	Plate, Throttle - Zenith #C21-55.....	1	.40
5	8885	Screw, Throttle Plate - Zenith #T183-3.....	1	.05
6	8886	Washer, Throttle Plate Screw - Zenith #T45-3.....	1	.05
7	8887	Screw, Main Jet Adj. - Zenith #C46-33.....	1	.30
8	8888	Nut, Adjusting - Incl. Packing - Zenith #C74-7 & CT58-1.....	1	.15
10	8889	Ball, Float - Zenith # C85-17.....	1	.50
11	8890	Jet, Float - Assembly - Zenith #C81-8.....	1	.75
12	22083	Washer, Float Jet Assembly.....	1	.05
13	8892	Screw, Carburetor Body - Zenith #T188-10.....	2	.05
14	8893	Washer, Carburetor Body Screw - Zenith #T41-8.....	2	.05
15	8907	Carburetor, Assembly Complete.....	1	6.00
16	8901	Gasket, Carburetor Manifold.....	1	.05
17	8902	Nut, Lock, Carburetor.....	1	.10
18	8957A	Control, Manual Choke Assembly.....	1	.35
19	666	Clip, Manual Choke Control.....	1	.15
MISCELLANEOUS GROUP (See Page 31.)				
1	1057A	Rope, Manual Starter - Includes Handle.....	1	.50
2	8118	Shield, Intake Manifold.....	1	.15
3	8402	Sheave, Rope.....	1	.90
4	8911	Gasket, Spark Plug.....	1	.05
5	8916	Handle, Carrying.....	1	.30
6	8910	Plug, Spark - J10 - Champion - 14MM.....	1	.65
7	19856A	Shield, Spark Plug - Assembly.....	1	.75
3	1743	Nut, Hex. - #10-32 - Spark Plug Shield.....	1	.01
9		Hydrometer, Battery.....	1	.75
10	8930	Muffler.....	1	1.50
1		Screw, Flat Hd. Mach. - 1/4"-20 x 1-1/4" - Carrying Handle.....	1	.01
1		Screw, Flat Hd. Mach. - 1/4"-20 x 1/2" - Carrying Handle.....	1	.01
1		Screw, Rd. Hd. Mach. - #10-32 x 1-1/2" - Saprk Plug Shield.....	1	.02
TOOL GROUP (Not Illustrated.)				
1	77510	Screwdriver - #7/42 - 3".....	1	.40
1	77535	Pliers - #938 - 6".....	1	.30
1	77581	Wrench, Breaker Point - #793.....	1	.10
1	77623	Wrench, Open End - #723 - 3/8" x 7/16".....	1	.40
1	77624	Wrench, Open End - #725 - 1/2" x 7/16".....	1	.45
1	77625	Wrench, Open End - #727 - 9/16" x 5/8".....	1	.50
1	77705	Wrench, Allen Head (for 3/8" Cap Screw).....	1	.15
1	77706	Wrench, Allen Head (for 1/4" Cap Screw).....	1	.15
1	77709	Wrench, Allen Head (for 10/32 Cap Screw).....	1	.15
1	77905	Kit, Tool - Assembly.....	1	3.00
1	77974	Bag, Canvas.....	1	.60
1		Washer, Plain - 17/64" I.D. x 9/16" O.D. - Governor Shaft.....	1	.01
1		Pin, Cotter - 1/2" x 1/16".....	1	.01
PARTS LIST				
MAGNETO GROUP (See Page 32.)				
1	8110	Housing, Blower.....	1	3.75
2	8400A	Flywheel, Magneto - Incl. Magnet Ring & Pole Piece Bolt, Magneto Flywheel.....	1	7.50
3	8403	Core, Magneto Coil - 5/8" (Laminated).....	1	.15
4	8408A	Coil, Magneto.....	1	1.00
5	8410	Cable, Magneto High Tension - Shielded.....	1	2.40
6	8412	Plate, Magneto Back.....	1	.45
7	8435	Plate, Magneto Back - Assembly.....	1	1.50
8	8435A	Bracket, Breaker Point.....	1	7.50
9	8438	Point, Breaker Set.....	1	.25
10	8975	Stud, Magneto Breaker Arm.....	1	.95
11	8441	Spring, Magneto Breaker Arm.....	1	.20
12	8443	Condenser, Magneto - .2 MFD EUC 10238.....	1	.75
13	8444	Lead, Magneto to Condenser Connector.....	1	.15
14	8445	Wire, Primary Ignition - #18 - Yellow - Flexible with Terminal - Magneto.....	1	.25
15	8446	Stud, 3/8" x 2-1/2" - #3135 - Flywheel to Crank-shaft.....	1	.10
2		Screw, Hex. Hd. - 5/16" x 5/8"-18 - Blower Hsg.....	2	.01
2		Screw, Rd. Hd. Mach. - 1/4"-20 x 1/2" - Mag. Mtg.....	2	.01
1		Screw, Rd. Hd. Mach. - #8-32 x 1/4" - Cond. Mtg.....	1	.01
1		Screw, Rd. Hd. Mach. - #8-32 x 3/8" - Cond. Mtg.....	1	.01
2		Screw, Rd. Hd. Mach. - #8-32 x 5/16" - Contact Point Bracket.....	2	.01
2		Screw, Rd. Hd. Mach. - #12-24 x 7/8" - Magneto.....	2	.01
2		Coil Core.....	2	.01
2		Screw, Binder Hd. - #10-32 x 5/8" - Blower Hsg.....	2	.01
2		Washer, Lock - #12 - Magneto Coil Core.....	2	.01
2		Lock Washer, Shakeproof - 1/4" - Inside - Point Bracket.....	2	.01
1		Washer, Lock - 3/8" - Heavy - Flywheel to Crank-shaft.....	1	.02
2		Lock Washer, Shakeproof - #8-32 - Inside - Condenser Mounting.....	2	.01
2		Washer, Lock - #8 - 3/64" I.D. x 5/64" O.D. - Contact Point Bracket.....	2	.01
1		Washer, Plain - 3/8" - Flywheel to Crankshaft.....	1	.01
2		Washer, Plain - 3/8" I.D. x .172 O.D. - Brass.....	2	.01
1		Washer, Plain - 9/64" I.D. x 5/16" O.D.....	1	.01
2		Washer, Lock - Light - Blower Housing.....	2	.01
FUEL SUPPLY GROUP (See Page 32.)				
1	1092A	Cap, Fuel Tank Assembly - Includes Gasket, Chain, Spring and Washer.....	1	.50
2	8156	Tank, Fuel - 3 Quart - Round.....	1	4.00
3	8159A	Cock, Fuel Shut-Off - Assembly with Screen.....	1	1.50
4	8161	Elbow, Compression Male - W6Ox3 Carburetor.....	1	.20
5	8162	Sleeve, Compression - W6Ox3.....	1	.02
6	8163	Nut, Compression - W61x3.....	1	.06
7	8166	Line, Fuel Assembly - Includes Nuts.....	1	1.00
2		Screw, Binder Hd. - #10-32 x 5/16" - Fuel Tank to Cylinder Block.....	2	.01

PARTS LIST			PARTS LIST		
REF. NO.	PART NO.	QUAN. USED	DESCRIPTION	PRICE EACH	PRICE EACH
GENERATOR GROUP (See Page 33.)					
1	75339	4	Brush, Carbon - M 5/2 X.....	.55	
2	842	4	Spring, Brush.....	.25	
3	8545A	1	Rig, Brush, Assembly - 12 Volt - Includes Brushes.	3.20	
4	8581	1	Lead, Brush to Line - #16 - Remote - White - 15 1/2".	.45	
5	8585	1	Jumper, Positive Brush - 12-Volt - #14 Rockbestos.	.30	
6	1131	1	Resistor, Field - 1.5 Ohm - 2" - Adjustable.....	1.00	
7	5928	1	Condenser, Line - 1 M.F.D.....	.50	
8	8515A	1	Armature, Assembly - 12 Volt - D.C.....	16.00	
9	1252	1	Stud, Armature Arbor Thru.....	.35	
10	1196	1	Washer, Armature Thru Stud - 7/8" O.D. x 13/32" I.D. x 1/8".....	.05	
11	8607	1	Frame, Generator.....	5.50	
12	8607A	1	Frame, Generator Assembly - 400 Watt - 12 Volt - DC	18.00	
13	8604	2	Washer, 1/4" x 13/32" x 1-1/4" - Gen. Frame Screw.	.05	
14	8624A	4	Piece, Pole, Assembly - 1" - 12 Volt - D.C.....	1.25	
15	8633A	1	Coil, Field, Assembly - 12 Volt D.C.....	7.50	
16	8632	4	Coil, Field (only) - 12 Volt - D. C.....	1.90	
17	8610B	1	Housing, Generator Bell.....	1.50	
18	8687B	1	Blower, Generator - Cast Iron.....	1.25	
19	8253B	1	Shroud, Generator Blower.....	1.40	
10434		1	Screw, Rd. Hd. Mach. - #10-32 x 5/8" - Resistance Terminal.....	.02	
		2	Screw, Rd. Hd. Mach. - #10-32 x 3" - Brush Cover Mounting.....	.05	
		2	Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Rig Mtg. Bracket.....	.02	
		4	Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Brush Term.	.01	
		2	Screw, Rd. Hd. Mach. - #10-32 x 3" - End Bell to Generator Frame.....	.01	
		2	Screw, Rd. Hd. Mach. - #10-32 x 1/4" - Shroud to Frame.....	.01	
10432		4	Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Brush Rig Mounting.....	.01	
		2	Screw, Socket Hd. - 1/4"-20 x 5/8" - Generator Blower to Generator.....	.03	
		2	Screw, Socket Hd. Cap - 3/8"-18 x 1-1/4" - Engine to Generator.....	.03	
		4	Screw Hex. Hd. - 3/8"-18 x 1" - Gen. Pole Piece...	.02	
		1	Nut, Hex. - 3/8"-24 - 5/16" x 9/16" - Armature Thru Stud.....	.02	
10552		8	Nut, Hex. - #10-32 - Brass - Brush Terminal.....	.02	
10632		8	Washer, Flat - #10-32 - brass - Brush Terminal and Post.....	.02	
		2	Washer, Lock - 1/4" - 1/16" x 1/16" - Generator Blower to Generator.....	.01	
		2	Washer, Lock - #10-32 - Brush Cover Mounting.....	.01	
10602		2	Washer, Lock - 3/8" - 1/8" x 3/32" - Engine to Gen.	.02	
		1	Washer, Lock - 3/8" x 1/8" x 3/32" - Armature thru Stud.....	.01	
		2	Washer, Lock - 7/32" x 1/16" I.D. x 3/64" O.D. - End Bell to Generator Frame.....	.01	
10617		8	Washer, Lock - #710 - Outside Shakeproof - Brush Terminal.....	.01	
		2	Washer, Shakeproof - #110 - Ext. - Shroud to Gen. Frame.....	.01	
8535		4	Washer, Shakeproof - #1210 - Brush Rig Mounting...	.01	
		1	Washer, 1/8" x 13/32" I.D. x 7/8" O.D. - Stud Armature.....	.01	
8504		2	Washer, 1/16" x 1-1/64" I.D. x 2" O.D. - Steel -		
CONTROL GROUP (See Page 34.)					
	8685A	1	Cabinet, Control Assembly - Includes Controls, Filter and Mounting Brackets.....	34.25	
	8685B	1	Base, Control Cabinet Mounting.....	2.25	
	8685	1	Cabinet, Control (only).....	3.50	
	8692D	1	Bracket, Control Cabinet Mounting.....	1.50	
	79521	1	Ammeter, Flush Type - 45-O-45.....	2.50	
	1687	1	Switch, Start - Assembly.....	1.00	
	12822A	1	Relay, Charge - Assembly.....	4.50	
	1630	1	Spring, Relay Armature - Sight.....	.10	
	1646	1	Frame, Relay.....	.95	
	1553	1	Panel, Relay Contact Insulation - Includes Contact Points.....	.60	
	1632	1	Blade, Charge Relay - Includes Point.....	.40	
	1513	1	Washer, Fibre Coil - 1-1/2" O.D.....	.10	
	1554	1	Strip, Reinforcing - 3/8" x 1" - Brass - For Instrument Panel.....	.05	
	1220	1	Condenser, Filter - .5 MFD.....	.75	
	77405	1	Filter, Deutchman - 1168.....	21.00	
	7903B	1	Bracket, Filter.....	.50	
	1720	1	Coil, Charge Relay - P.S. 1065 - 12 Volt.....	1.50	
	8767	1	Lead, Start Switch to Ammeter Lead.....	.15	
	8768	1	Lead, Start Switch to Battery (positive Term.)..		
	8766A	1	Post, Terminal Assembly (Ground).....	.15	
	8776	1	Lead, Ammeter to Positive Terminal.....		
		1	Screw, Hex. Hd. - 1/4"-20 x 7/8" - Bracket to Cylinder Head Cover.....	.01	
		1	Screw, Hex. Hd. - 1/4"-28 x 3/8" - Bracket to Cylinder Head Cover.....	.01	
		1	Screw, Rd. Hd. Mach. - 1/4"-20 x 1-1/4" - Brass-Terminal Post.....	.03	
		10	Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Steel - Cover to Control Box.....	.01	
		1	Screw, Rd. Hd. Mach. - #8-32 x 3/8" - Steel - Condenser to Control Box.....	.01	
		2	Screw, Rd. Hd. Mach. - 1/4"-20 x 1/2" - Start Switch to Control Box.....	.01	
		1	Screw, Rd. Hd. Mach. - 1/4"-20 x 1-1/4" - Brass-Battery Terminal Post.....	.02	
		2	Screw, Rd. Hd. Mach. - #8-32 x 5/16" - Front Control Panel.....	.01	
		1	Nut, Hex. - #8-32 - Steel - Condenser to Control Box.....	.01	
		2	Nut, Hex. - 1/4"-20 - Start Switch to Control Box	.01	
		2	Nut, Hex. - 1/4"-28 - Brass - Terminal Stud.....	.02	
		2	Nut, Hex. - 1/4" - Brass - Relay to Control Box (1) Charge Relay (1).....	.01	
		1	Nut, Hex. - 1/4" - Brass - Relay Assembly.....	.02	
		5	Washer, Plain - 1/4" I.D. x 1/16" O.D. - Terminal Post (2), Terminal Stud (3).....	.01	
		4	Washer, Plain - 1/4" I.D. x 1/16" O.D. - Brass - Terminal Binding.....	.02	
		10	Washer, Lock - 3/16" - Cover to Control Box.....	.01	
		2	Washer, Lock - 1/4" - Start Switch.....	.01	
		6	Washer, Insulating - 1/4" I.D. x 1/16" O.D. - Terminal Post (2), Terminal Binding (4).....	.01	
		1	Washer, Insulating - 1/4" - Charge Relay Terminal Post.....	.01	
		2	Washer, Lock - Shakeproof - #1108 - Control Box Cover.....	.01	
		1	Washer, Shakeproof Lock - #1208 - Condenser to		

PARTS LIST			PARTS LIST		
REF. NO.	QUAN. USED	DESCRIPTION	REF. NO.	QUAN. USED	DESCRIPTION
GENERATOR GROUP (See Page 33.)			CONTROL GROUP (See Page 34.)		
1	75339	Brush, Carbon - M 5/2 X.....	1	8685A	Cabinet, Control Assembly - Includes Controls, Filter and Mounting Brackets.....
2	842	Spring, Brush.....	1	8685B	Base, Control Cabinet Mounting.....
3	8545A	Rig, Brush, Assembly - 12 Volt - Includes Brushes.....	1	8685	Cabinet, Control (only).....
4	8581	Lead, Brush to Line - #16 - Remote - White - 1 1/4".....	1	8692D	Bracket, Control Cabinet Mounting.....
5	9585	Jumper, Positive Brush - 12-Volt - #14 Rockbestos.....	1	79521	Ammeter, Flush Type - 45-0-45.....
6	1131	Resistor, Field - 1.5 Ohm - 2" - Adjustable.....	1	1687	Switch, Start - Assembly.....
7	5928	Condenser, Line - .1 M.F.D.....	1	12822A	Relay, Charge - Assembly.....
8	8515A	Armature, Assembly - 12 Volt - D.C.....	1	1630	Spring, Relay Armature - Sight.....
9	1252	Stud, Armature Arbor Thru.....	1	1646	Frame, Relay.....
10	1196	Washer, Armature Thru Stud - 7/8" O.D. x 1 3/32" I.D. x 1/8".....	1	1553	Panel, Relay Contact Insulation - Includes Contact Points.....
11	8607	Frame, Generator.....	1	1632	Blade, Charge Relay - Includes Point.....
12	8607A	Frame, Generator Assembly - 400 Watt - 12 Volt - DC.....	1	1513	Washer, Fibre Coil - 1-1/2" O.D.....
13	8604	Washer, 1/4" x 1 3/32" x 1-1/4" - Gen. Frame Screw.....	1	1554	Strip, Reinforcing - 3/8" x 1" - Brass - For Insulating Panel.....
14	8624A	Piece, Pole, Assembly - 1" - 12 Volt - D.C.....	1	1220	Condenser, Filter - .5 MFD.....
15	8633A	Coil, Field, Assembly - 12 Volt D.C.....	1	77405	Filter, Deutchman - 1168.....
16	8632	Coil, Field (only) - 12 Volt - D. C.....	1	7903B	Bracket, Filter.....
17	8610B	Housing, Generator Bell.....	1	1720	Coil, Charge Relay - P.S. 1065 - 12 Volt.....
18	8637B	Blower, Generator - Cast Iron.....	1	8767	Lead, Start Switch to Ammeter Lead.....
19	8253B	Shroud, Generator Blower.....	1	8768	Lead, Start Switch to Battery (positive Term.).....
10434		Screw, Rd. Hd. Mach. - #10-32 x 5/8" - Resistance Terminal.....	1	8766A	Post, Terminal Assembly (Ground).....
		Screw, Rd. Hd. Mach. - #10-32 x 3" - Brush Cover Mounting.....	1	8776	Lead, Ammeter to Positive Terminal.....
		Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Rig Mtg. Bracket.....	1		Cylinder Head Cover.....
		Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Brush Term. Screw.....	1		Cylinder Head Cover.....
		Screw, Rd. Hd. Mach. - #10-32 x 3" - End Bell to Generator Frame.....	1		Terminal Post.....
		Screw, Rd. Hd. Mach. - #10-32 x 1/4" - Shroud to Frame.....	10		Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Steel - Cover to Control Box.....
10432		Screw, Rd. Hd. Mach. - #10-32 x 3/8" - Brush Rig Mounting.....	1		Screw, Rd. Hd. Mach. - #8-32 x 3/8" - Steel - Condenser to Control Box.....
		Screw, Socket Hd. - 1/4"-20 x 5/8" - Generator Blower to Generator.....	2		Screw, Rd. Hd. Mach. - 1/4"-20 x 1 1/2" - Start Switch to Control Box.....
		Screw, Socket Hd. Cap - 3/8"-18 x 1-1/4" - Engine to Generator.....	1		Screw, Rd. Hd. Mach. - 1/4"-20 x 1-1/4" - Brass - Battery Terminal Post.....
		Screw Hex. Hd. - 3/8"-18 x 1" - Gen. Pole Piece.....	2		Screw, Rd. Hd. Mach. - #8-32 x 5/16" - Front Control Panel.....
1		Nut, Hex. - 3/8"-24 - 5/16" x 9/16" - Armature Thru Stud.....	1		Nut, Hex. - #8-32 - Steel - Condenser to Control Box.....
8	10552	Nut, Hex. - #10-32 - Brass - Brush Terminal.....	2		Nut, Hex. - 1/4"-20 - Start Switch to Control Box.....
8	10632	Washer, Flat - #10-32 - brass - Brush Terminal and Post.....	2		Nut, Hex. - 1/4" - Brass - Relay to Control Box (1) Charge Relay (1).....
2		Washer, Lock - 1/4" - 1/16" x 1/16" - Generator Blower to Generator.....	1		Nut, Hex. - 1/4" - Brass - Relay Assembly.....
2		Washer, Lock - #10-32 - Brush Cover Mounting.....	5		Washer, Plain - 1/4" I.D. x 1/16" O.D. - Terminal Post (2), Terminal Stud (3).....
2	10602	Washer, Lock - 3/8" - 1/8" x 3/32" - Engine to Gen. Stud.....	4		Washer, Plain - 1/4" I.D. x 1/16" O.D. - Brass - Terminal Binding.....
1		Washer, Lock - 3/8" x 1/8" x 3/32" - Armature thru Stud.....	10		Washer, Lock - 3/16" - Cover to Control Box.....
2		Washer, Lock - 7/32" x 1/16" I.D. x 3/64" O.D. - End bell to Generator Frame.....	2		Washer, Lock - 1/4" - Start Switch.....
8	10617	Washer, Lock - #710 - Outside Shakeproof - Brush Terminal.....	6		Washer, Insulating - 1/4" I.D. x 1/16" O.D. - Terminal Post (2), Terminal Binding (4).....
2		Washer, Shakeproof - #110 - Ext. - Shroud to Gen. Frame.....	1		Washer, Insulating - 1/4" - Charge Relay Term. inal Post.....
4		Washer, Shakeproof - #1210 - Brush Rig Mounting.....	2		Washer, Lock - Shakeproof - #1108 - Control Box Cover.....
1	8535	Washer, 1/8" x 1 3/32" I.D. x 7/8" O.D. - Stud Armature.....	1		Washer, Shakeproof Lock - #1208 - Condenser to
2	8504	Washer, 1/16" x 1-1/64" I.D. x 2" O.D. - Steel -			

REF. NO.	PART NO.	QUAN. USED	PARTS LIST DESCRIPTION	PRICE EACH
		10	Washer, Lock - 3/16" - Cover to Control Box.....	.01
		2	Washer, Lock - 1/4" - Start Switch.....	.01
		6	Washer, Insulating - 1/4" I.D. x 1/16" O.D. - Terminal Post (2), Terminal Binding (4).....	.01
		1	Washer, Insulating - 1/4" - Charge Relay Term. Post	.01
		2	Washer, Lock - Shakeproof - #1108 - Control Box Cover.....	.01
		1	Washer, Shakeproof Lock - #1208 - Condenser to Control Box.....	.01
		4	Washer, Shakeproof - # 1214 - Terminal Post (2), Terminal Stud (1), Terminal Binding (1).....	.01